CRUISE REPORT
C-101

SCIENTIFIC ACTIVITIES

6 July - 12 August 1988

SSV CORWITH CRAMER

Sea Education Association
Woods Hole, Massachusetts

SEA EDUCATION ASSOCIATION SEA SEMESTER 101

SHIP

SSV <u>CORWITH CRAMER</u>

DATES

6 July - 12 August 1988

STUDY AREA

The cruise track covered approximately 3600 km in the Northwest Atlantic Ocean (Fig. 1).

PORTS OF CALL

Departed Woods Hole, Massachusetts:	6 July 1988
Grand Bank, Newfoundland:	18 July 1988
St. Albans, Newfoundland:	20 July 1988
Sable Island, Canada:	24 July 1988
Lunenburg, Nova Scotia:	28-30 July 1988
Rockland, Maine:	4 August 1988
North Haven, Maine:	5 August 1988
Woods Hole, Massachusetts:	12 August 1988

SCIENTIFIC PROGRAM

<u>Physical and chemical oceanography</u>

30 Conductivity-temperature-depth (CTD) measurements
8 Hydrocasts
71 Bathythermographs
46 Surface-water analyses
20 Weather reports transmitted to NOAA

<u>Geological oceanography</u>

21 Sediment grabs
1 Dredge
1 Gravity core

<u>Biological oceanography</u>

28 Neuston net tows
6 Meter net tows
4 Otter trawls
1 Phytoplankton net tow
1 Dip net

PARTICIPANTS

Nautical Staff:

Terry Hayward	Captain
Bill Burke	Chief mate
Cameron Bright	Second mate, 6 July - 28 July 1988
Geoff Jones	Second mate, 28 July - 12 August 1988
Laura Norris	Third mate
Greg Lohse	Engineer
Arria Merrill	Steward

Scientific Staff:

Bill Corso	Chief scientist
Cliff Low	First assistant scientist
John Sullivan	Second assistant scientist
Beth Miller	Third assistant scientist

Students:

Karen Baker	Purdue University
Nicole Brownson	Albion College
Greg Burdick	University of Wisconsin
Matt Gallaway	Cornell University
Sarah Himmerich	Beloit College
Forsyth Kineon	Colby College
Jen Life	Hofstra University
Cam Mackey	Princeton University
Hank Mayer	Middlebury College
Andy Michaels	Harvard College
Ed Mitzen	Syracuse University
Sarah Mixter	Cornell University
Susan Palmer	Middlebury College
Sarah Parkin	University of Massachusetts
Chris Pittner	Kenyon College
Bob Rogers	Colby College
Nicole Ruderman	Colgate University
Eric Sigler	University of Massachusetts
Andy Singer	Bowdoin College
Andy Stroehlein	Cornell University
Melanie Wass	Lake Forest College
Molly Whitehead	Harvard-Radcliffe Colleges
Zev Winicur	Indiana University
Sarah Zimmermann	Mt. Holyoke College

Visitors:

Paul Joyce	6 July - 28 July 1988
Stuart Klipper	6 July - 20 July 1988
Spencer Apollonio	30 July - 4 August 1988
John Arrison	30 July - 4 August 1988
Bob Boudreau	5 August - 12 August 1988

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INTRODUCTION

This cruise report outlines the scientific research program conducted on board the SSV CORWITH CRAMER during Sea Education Association's Sea Semester 101. The study area encompassed the Northwest Atlantic continental shelf and slope from Woods Hole, Massachusetts, to Grand Bank, Newfoundland (Fig. 1). Plankton, tar and plastic samples were collected throughout the cruise, while fish and benthic organisms were collected from Georges Bank and the Scotian Shelf. All of the water masses encountered along the cruise track (i. e., shelf, slope, warm core eddy, and Bay D'Espoir) were analyzed for temperature, salinity, pH, dissolved oxygen content, phosphate concentration, silicate concentration, and chlorophyll a concentration. Sediment grabs were taken on Georges Bank, St. Pierre Bank, the Scotian Shelf, and in Bay D'Espoir, while a dredge was taken on the Scotian Shelf and a gravity core in the Gulf of Maine.

The abstracts of student research projects which the students defined during the shore component of Sea Semester 101, comprise much of this report. These abstracts are edited versions of those written at sea and are not intended to represent the final analysis or interpretation of data collected during C-101.

The principal results of the research conducted aboard the SSV CORWITH CRAMER were:

1. Sill bathymetry in Bay D'Espoir, Newfoundland, is very complex and influences deep-water exchange in the bay;
2. Bay D'Espoir is an exceptional environmental setting

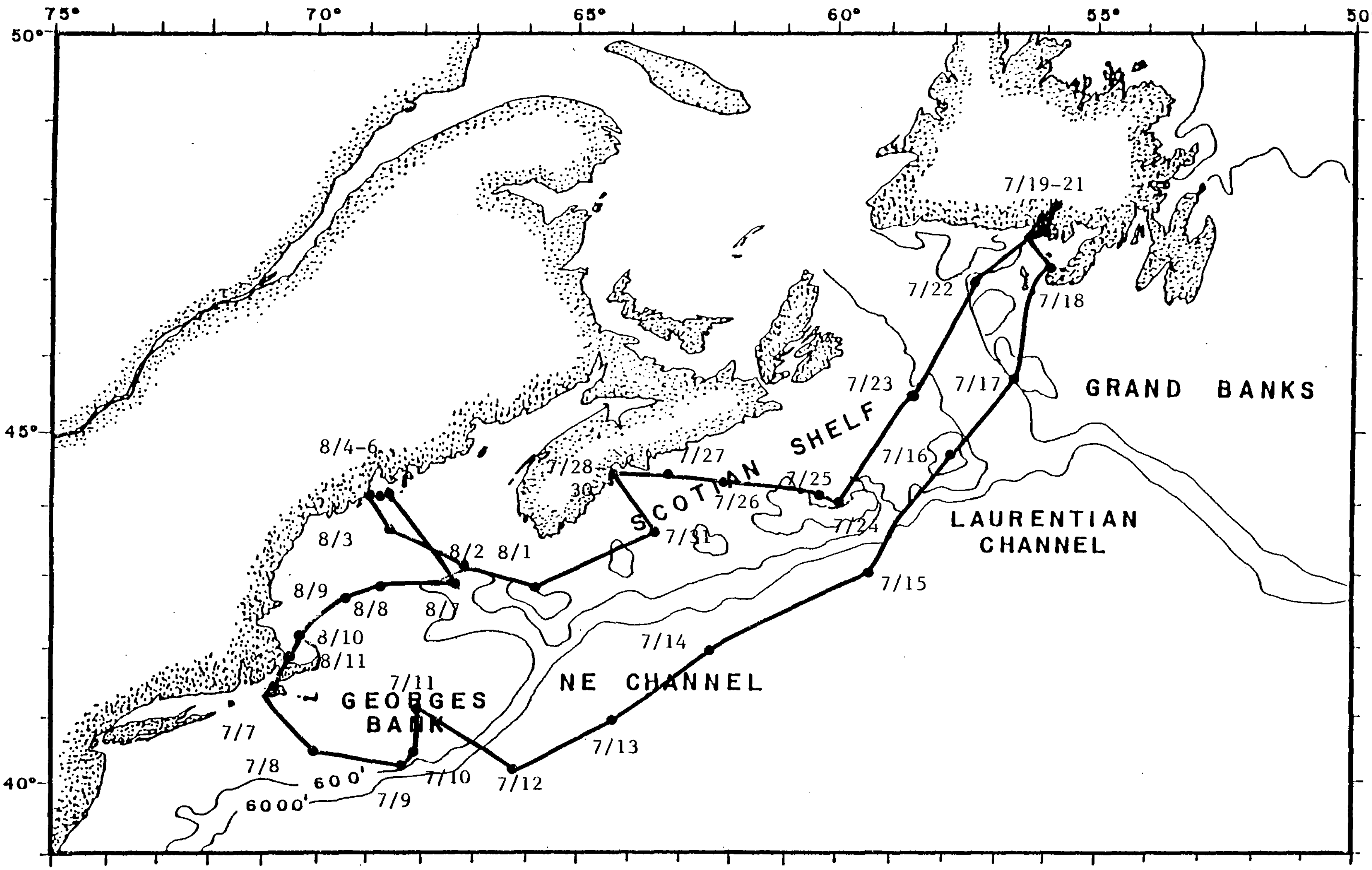

Figure 1. Cruise track for SEA class 101 aboard the CORWITH CRAMER (6 July-12 August 1988; Woods Hole to Woods Hole, MA).

characterized by waters enriched with tannic acid, relatively high concentrations of phosphate, silicate and chlorophyll, well-oxygenated deep-water, no fish larvae, a limited variety of intertidal flora and fauna, and primarily muddy sediments derived from erosional processes occurring along the entire length of the bay;

3. Planktonic distribution patterns reflect interactions among physical, chemical and biological processes;
4. Fish populations and adaptations are affected strongly by habitat;
5. Relative abundances of tar and plastic are controlled by source locations and physical processes;
6. The boundary between Georges Bank shelf water and slope water is characterized by complex mixing above the shelfbreak;
7. The types and sizes of sediments deposited along the axis of Oceanographer Canyon correspond with those along the canyon's walls.

BATHYMETRY OF SILLS IN BAY D'ESPOIR, NEWFOUNDLAND

Karen D. Baker

Bay D'Espoir is a fjord on the southern coast of Newfoundland, and its bathymetry is characterized by a series of shallow-water sills. The acoustic character and bathymetry of two of these sills, Copperhead and Little Crow, were studied in detail using a 3.5 kHz precision depth recorder (PDR).

Copperhead Sill is approximately 70 m deep on the western side of the bay and less than 60 m deep on the eastern side. The shallower eastern side of this sill appears to guide incoming ocean water toward the deeper, western side, while water passing over the eastern side of the sill is turbulently mixed (see Stroehlein, this report).

The bathymetry of Little Crow Sill, which is upstream from Cooperhead Sill, is characterized by a series of highs that extend up to about 30 m below sea level and lows reaching 100 m or deeper. These lows form passages through the sill, thus the sill does not form a continuous barrier across the bay.

Sill structure was evaluated also using the PDR records and bottom grabs (see Parkin, this report). Both sills are characterized by sharp bottom echoes with no subbottom reflectors, and they are interpreted as resistant rock outcrops with little or no overlying sediment.

SEDIMENT-SIZE DISTRIBUTION PATTERNS, BAY D'ESPOIR, NEWFOUNDLAND

Sarah Jane Parkin

Ten sediment samples were collected from Bay D'Espoir, Newfoundland, to determine if sills within the bay restrict the oceanward transport of sediment from the head of the bay to its mouth. The majority of samples consisted of mud with gravel-size pieces of quartz, chert, basalt, gneiss and granite floating in the mud matrix. There were no distinctive sediment distribution patterns associated with either Copperhead or Little Crow sills. Mud, and mud with gravel, occurred both seaward and landward of both sills.

Sediment is probably being deposited in the bay by erosional processes that are occurring along the entire length of the bay (see Sigler, this report). Therefore, the effectiveness of the sills as downstream barriers to sediment distribution could not be adequately evaluated.

CURRENT EROSIONAL PROCESSES OF BAY D'ESPOIR, NEWFOUNDLAND

Eric Sigler

Bay D'Espoir is a fjord on the southern coast of Newfoundland that formed during the last glaciation. Glacial activity resulted in rock striations, drumlins, hanging valleys and rounded valley shapes.

This study evaluated the geomorphology around the bay and the bay's bathymetry to document erosional processes that are occurring throughout the bay today. Along many of the steeply-dipping slopes encircling the bay, stream erosion and runoff transport material into the bay. Moreover, frost wedging, bioerosion, and wave action are all actively undercutting the slopes. The bases of these slopes are characterized by overlapping hyperbolic bottom echoes, suggesting that material eroded from the slopes has accumulated in irregular deposits forming rugged bathymetry.

Because erosional processes were evident along the entire coastline of the bay, material transported into the bay probably originated from line sources around the bay and not from a point source at the head of the bay.

TIDAL FLUXES AND DEEP-WATER RENEWAL, BAY D'ESPOIR, NEWFOUNDLAND

Andy Stroehlein

Deep-water renewal across Copper Head Sill in Bay D'Espoir, Newfoundland, was analyzed by taking measurements with a conductivity-temperature-depth sensor (CTD). A wedge of high-density water occurred between 24-31 m below sea level (peak density ranged from 1.0258 to 1.0280 g/cc). This wedge was most prominent immediately landward of the sill and in the outer basin of the bay.

Because this wedge could not be traced continuously from the sill to Hermitage Bay, its origin remains engimatic; however, it was obviously crossing over the sill. One possible explanantion is that high-density water moves into the bay in association with the tide. Since the stations in this study varied through time and the tidal cycle, a complete picture of deep-water renewal was not possible. Future studies should conduct 24-hour stations on both sides of the sill and in the outer bay to document tidal exchange in the bay.

PHOSPHATE AND SILICATE CONCENTRATIONS IN THE NORTHWEST ATLANTIC OCEAN AND BAY D'ESPOIR, NEWFOUNDLAND

Sarah Himmerich

This study evaluated the concentrations of phosphate and silicate in the different water masses (i. e., slope, shelf, warm core eddy, and Bay D'Espoir) encountered along cruise C-101. Twenty samples were analyzed colorimetrically using a spectrophotometer.

Phosphate and silicate concentrations in Bay D'Espoir were about 0.1 umoles/l and 2.0-16.0 umoles/l, respectively, while phosphate concentrations were less than 0.1 umoles/l and silicate concentrations were about 1.0-2.0 umoles/l in slope and shelf waters.

The relatively high values encountered in Bay D'Espoir probably reflect the bay's proximity to land and increased input from terrestrial runoff.

THE EFFECTS OF TANNIC ACID ON PHYTOPLANKTON BIOMASS IN BAY D'ESPOIR, NEWFOUNDLAND

Nicole Brownson

Tannic acid, a complex organic compound produced by plants, occurs in the waters of Bay D'Espoir, Newfoundland, and it probably enters the bay through freshwater runoff and groundwater seepage. Tannic acid could potentially influence phytoplankton growth in the bay by: 1) decreasing the pH of bay water, or 2) limiting light penetration. This study evaluated the effects of tannic acid concentrations on phytoplankton by: 1) measuring light penetration with an irradiometer, 2) estimating light quantity by calculating extinction coefficients, 3) measuring the pH of the water with an electronic pH meter, and 4) estimating phytoplankton biomass with chlorophyll a concentrations.

Chlorophyll a concentrations varied from about 6.0 mg/l at the mouth of the bay to about 39.0 mg/l at the head of the bay; whereas pH values varied from 7.09 to 7.68, respectively. Light penetration and extinction coefficients decreased to negligible values at about 25 m below the surface of the bay.

The effects of tannic acid concentrations on phytoplankton biomass in the bay could not be accurately assessed. There were no correlative trends among chlorophyll concentrations, pH values, and extinction coefficients. Major drawbacks encountered in this study were the unreliability of the pH meter and lack of a tannic acid measuring kit. Future studies should readdress this problem, but those students are urged to consider the problems encountered in this study and try to compensate for them as best as possible.

EPIBIOTA ASSOCIATED WITH *ASCOPHYLLUM* AND *FUCUS* IN INTERTIDAL AND PELAGIC ENVIRONMENTS

Greg Burdick

Ascophyllum and *Fucus* are two genera of seaweed that grow in the intertidal zone but are frequently transported into the pelagic environment, where they survive for a period of time. Epibiota associated with *Ascophyllum* and *Fucus* from the intertidal and pelagic environments were contrasted in this study. The epibionts found on seaweed from the intertidal zone included: copepods, amphipods, and polychaete larvae, while the epibionts found on pelagic seaweed included: copepods, decapods, euphausids, isopods, fish eggs, barnacles, bryozoans, and worms. These observations, however, must be qualified. A limited number of seaweed specimens were collected from the intertidal zone, and the primary process for collecting pelagic seaweed (i. e., neuston net tows) probably resulted in atypical associations between plankton and seaweed.

GASTROPOD SPECIES DISTRIBUTION IN THE INTERTIDAL ZONE OF BAY D'ESPOIR, NEWFOUNDLAND

Zev Winicur

Bay D'Espoir, a fjord on the southern coast of Newfoundland, has salinities ranging from about 35 parts per thousand (ppt) at its mouth to 2 ppt at its head. Intertidal gastropods of this area and their salinity tolerances have not been well documented. This study, therefore, investigated intertidal gastropod species distribution, abundances, and salinity tolerances by identifying and counting gastropods at four sites throughout the bay. Salinities were measured with a conductivity-temperature-depth sensor at one site and a salinometer at the others.

Only one species was found at each of three sites and none at the fourth. _Littorina saxatilis_ occurred at a site with a salinity of about 24.0 ppt, _Littorina obtusata_ at a site with about 19.9 ppt, and _Littorina littorea_ at a site with 4.6 ppt. These data suggest that salinity is a major factor in controlling gastropod species distribution throughout the bay.

FISH LARVAE DISTRIBUTION PATTERNS, BAY D'ESPOIR, NEWFOUNDLAND

Molly Whitehead

Estuarine conditions typically promote that production of energy-rich detrital food, which supports many organisms including fish larvae. Indeed, estuaries are generally regarded as nurseries for many species of fish.

Bay D'Espoir is a fjord (a type of estuary) on the southern coast of Newfoundland, and this study determined the abundance of fish larvae in the bay by taking daily neuston net tows. No fish larvae were found in Bay D'Espoir. There are two possible explanations. First, the bay has a relatively high concentration of tannic acid (see Brownson, this report), and this acid might have a detrimental effect on fish reproduction in the bay. Alternatively, the occurrence of fish larvae is seasonally controlled and the time spent in the bay may have been a period of no reproduction.

THE EFFECTS OF HYDROELECTRIC DEVELOPMENT ON THE INTERTIDAL ZONE OF BAY D'ESPOIR, NEWFOUNDLAND

Susan Palmer

To document the environmental impact of two hydroelectric plants, built both on and around Bay D'Espoir, Newfoundland, the intertidal flora and fauna at two sites in the bay were analyzed. The first site was near the mouth of the bay and not near either plant. The second site was approximately 40 km farther upstream from site 1 and nearer to both plants. At both sites, organisms were counted and percent-cover determined with a random-dot sampling technique used by a previous investigator.

At site 1, approximately 1/3 of the substrate was covered by seaweed (*Ascophyllum* and *Fucus*) and invertebrates (*Littorina* sp.). At site 2, approximately 1/2 of the substrate was covered with *Ascophyllum*, *Fucus*, and invertebrates (*Balanus*, *Littorina* sp., and *Cladophora*). Moreover, individual *Littorina* were larger than those found at site 1.

The greater abundances of organisms and their larger sizes at site 2, the site nearer to the hydroelectric plants, suggest that the plants may not have an adverse impact on the ecology of the bay's intertidal zone.

Georges Bank Studies

HYDROGRAPHY OF THE GEORGES BANK SHELF/SLOPE FRONT

Bob Rogers

The Georges Bank Shelf/Slope front is a permanent hydrologic feature along the Northwest Atlantic continental margin, which separates cold, relatively fresh coastal waters on the shelf from warm, saline waters off the slope. To characterize this front, an electronic bathythermograph was deployed every five to eight miles across Georges Bank and the shelfbreak.

Temperature data clearly indicate two distinct water masses: 1) Georges Bank shelf water, and 2) slope water. The boundary between these two water masses occurred above the shelfbreak and was characterized by complex mixing. This boundary was interpreted as the shelf/slope front.

SEDIMENT DISTRIBUTION PATTERNS IN OCEANOGRAPHER CANYON

Forsyth P. Kineon and Nicole Ruderman

Sediment distribution patterns in Oceanographer Canyon, which lies on the southeast corner of Georges Bank, were studied using a seafloor sampler and 3.5 kHz precision depth recorder. Six samples were collected from in and around the canyon, two from the canyon axis and four from the canyon wall. All six samples consisted of fine-grained, moderately sorted, terrigenous clastic sand. There were no significant differences between sediment from the canyon axis and wall, suggesting that material from the canyon wall is transported downslope and accumulates along the axis of the canyon.

Biological Oceanographic Studies

PHYTOPLANKTON BIOMASS RELATIVE TO NUTRIENT AVAILABILITY AND CIRCULATION PATTERNS, NORTHWEST ATLANTIC OCEAN

Hank Mayer

Phytoplankton biomass (as estimated using chlorophyll *a* concentrations) in shelf and slope waters was contrasted to water temperature and phosphate concentrations. The mean chlorophyll values decreased from about 0.03 mg/l at 40^{o} N to 0.015 mg/l at about 48^{o} N. Temperature ranged from 17^{o} C on Georges Bank to a low of 10^{o} C on St. Pierre Bank near Bay D'Espoir. Phosphate concentrations were highest in the bay (see Himmerich, this report).

There were no readily identifiable correlations between chlorophyll concentrations, water temperature and phosphate concentrations. Because of the relatively small volume of water filtered and spectrophotometrically analyzed for chlorophyll (i. e., 150 ml), the chlorophyll data may not have been reliable. Future studies should plan on using the fluorometer or larger volumes of filtered water to determine chlorophyll concentrations.

HORIZONTAL DISTRIBUTION OF CHAETOGNATHS, NORTHWEST ATLANTIC CONTINENTAL SHELF

Sarah Zimmermann

The number of chaetognaths (arrow worms) per cubic meter of seawater were determined along the Northwest Atlantic continental shelf using neuston net tows. Georges Bank and the Scotian Shelf yielded a greater abundance of chaetognaths (about $5/m^3$) than slope water off the continental shelf (about $1-2/m^3$). No chaetognaths were found in the Laurentian Channel, Hermitage Bay, and Bay D'Espoir.

The chaetognaths were more abundant in night tows than day tows, thus confirming their diel migration. Moreover, they were more abundant where there were higher concentrations of copepods (see Life, this report), suggesting a causal relationship between the organisms (i. e., predator-prey).

COPEPOD DISTRIBUTION PATTERNS, NORTHWEST ATLANTIC OCEAN

Jen Life

Copepods are the most abundant type of zooplankton in the world's ocean. This study documented their horizontal distribution patterns in the surface waters of the Northwest Atlantic Ocean by taking daily neuston net tows, and identifying and counting the copepods. The most abundant concentrations of copepods were found on Georges Bank and in Bay D' Espoir, while fewer organisms were found in slope and warm core eddy waters. Moreover, copepod abundances increased as water temperature decreased; the greatest percentage of copepods per total zooplankton biomass occurred in regions with 12 ^{o}C water.

FISH LARVAE AND COPEPOD DISTRIBUTION PATTERNS, NORTHWEST ATLANTIC OCEAN

Melanie Wass

The horizontal distribution patterns of fish larvae and copepods found in the surface layer of the Northwest Atlantic Ocean were determined by taking daily neuston net tows. Copepods were the most abundant (i. e., greater than 50% of the total zooplankton biomass) on Georges Bank, while the largest concentration of fish larvae (i. e., about 2% of the total zooplankton biomass) occurred near Oceanographer Canyon and in the Laurentian Channel. There was no apparent correlation between fish larvae and copepod abundances although copepods are an important food source for fish larvae.

HORIZONTAL DISTRIBUTION PATTERNS OF MESOPELAGIC FISH, NORTHWEST ATLANTIC OCEAN

Sarah Mixter

The horizontal distribution of mesopelagic fish in the Northwest Atlantic was evaluated by identifying and counting fish caught primarily in daily neuston net tows and six meter net tows. All of the tows that collected mesopelagic fish were conducted in slope water, adjacent to the continental shelfbreak, where water depths exceeded 1000 m.

Four genera of myctophids were identified (i. e., *Notoscopelus*, *Symbolophorus*, *Gonichthys*, and *Hygophum*). In addition to myctophids, gonostomatids were recovered. Fish were caught in slope water: 1) immediately adjacent to Oceanographer Canyon on Georges Bank, 2) adjacent to Northeast Channel, and 3) adjacent to the Scotian shelf. Not all of the tows in these areas, however, recovered fish. The horizontal distribution of mesopelagic fish could not be predicted.

DEMERSAL FISH POPULATIONS ON THE NORTHWEST ATLANTIC CONTINENTAL SHELF

Cam Mackey

This study compared demersal fish populations on Georges Bank and the Scotian Shelf with water depth, water temperature, seafloor bathymetry, and sediment type. Silver Hake dominated the otter trawl catch from Georges Bank, while American Plaice Flounder and Red Hake dominated the two trawls from the Scotian Shelf.

Of the many controlling factors, only sediment type siginificantly varied among the sample sites, suggesting that it had the greatest effect on demersal fish populations. The character of the seafloor changes from medium and coarse-grained sand on Georges Bank to fine-grained sand and mud on the Scotian Shelf.

FISH SWIMBLADDER DEVELOPMENT COMPARED TO THE CONCENTRATION OF DISSOLVED OXYGEN AND WATER PRESSURE

Andrew Michaels

Many pelagic fish use a swimbladder to provide neutral buoyancy while migrating to different depths. This study evaluated the effects of water pressure and dissolved oxygen concentration on the morphology of swimbladders of fish from Georges Bank and the Scotian Shelf. Ratios of Rete mirabile length to swimbladder volume and gas gland surface area to swimbladder volume were used to quantify the relative efficiency of the swimbladder. The higher the ratios the more efficient the swimbladder because of more area for gas exchange.

Redfish had the highest Rete to swimbladder and gas gland to swimbladder ratios (about 0.4), while Atlantic Cod, Silver Hake, and Red Hake ratios varied from about 0.3 to 0.04.

Because all fish were collected from relatively similar depths (i. e., 45-85 m) and surface oxygen concentrations could only be determined, the preferred habitat of the fish were compared to swimbladder efficiency. The Redfish has the most efficient swimbladder and typically lives at greater depths than any of the other fish caught, suggesting that water pressure and dissolved oxygen content correlate with swimbladder efficiency.

SWIMMING EFFICIENCY AND MYCMERE STRUCTURE OF NEKTONIC FISHES, NORTHWEST ATLANTIC OCEAN

Edward G. Mitzen

This study examined the hydrodynamic characteristics of ten nektonic fish, caught in two otter trawls on the Scotian Shelf. The width to length ratios of these fish were measured and compared to the results of previous work, which suggested that optimum hydrodynamic body-form has a ratio of 0.25. In addition, the lateral musculature of the fish was analyzed by comparing the number of lateral muscle bands (myomeres) to tissue surface examined.

Atlantic Cod and Sculpins had body-form ratios of about 0.2 and had the least amount of lateral musculature per surface area. Pipefish, Red Hake and Redfish had body-form ratios ranging from 0.1 to 0.3, and they had the largest number of myomeres per surface area.

The correlation between near optimum body-form ratio and myomere abundance suggests a cause and effect relationship (i. e., the greater the hydrodynamic characterics of the body-form, the less musculature needed for propulsion).

Pollution Studies

PELAGIC TAR AND PLASTIC DISTRIBUTION PATTERNS, NORTHWEST ATLANTIC OCEAN

Matt Gallaway and Chris Pittner

This study evaluated the concentration, distribution, and relative condition of tars and plastics entrained in the surface layer along the entire cruise track of C-101 (Fig. 1). Of the 28 neuston net tows conducted, 10 recovered tars and plastics. Tows within slope water, a warm core eddy, and in the Laurentian Channel included numerous tar particles (i. e., greater than 10 per tow) and a limited number of plastic pieces (i. e., about 1-2 pieces per tow), while the tows within shelf waters and in the Bay D'Espoir recovered fewer pollutants. This distribution pattern probably reflects the effects of the Gulf Stream and Labrador Current. Because tars and plastics occurred in patches, localized water movements (e. g., wind-derived currents) also probably contributed to their distribution patterns.

HORIZONTAL DISTRIBUTION OF MICROTAR AND MICROPLASTICS, NORTH ATLANTIC OCEAN

Andy Singer

This study determined the horizontal distribution patterns of microscopic fibers, tar balls, and plastic pieces in the Northwest Atlantic Ocean by filtering water samples through a 45 um filter and then analyzing the particulate matter with a dissecting microscope. Samples were taken from Georges Bank, shelf, slope, Gulf Stream warm core eddy, Scotian Shelf, and Bay D'Espoir waters.

The average number of microtar particles per 100 ml of water varied from 562 in the warm core and 400-500 on both Georges Bank and the Scotian Shelf to 200 in the Laurentian Channel and Bay D'Espoir. The average number of microplastic fibers and pieces per 100 ml of water ranged from 48 in the warm core to 25 on the continental shelf and bay to 12 in the Laurentian Channel.

Three trends were apparent: 1) the highest concentration of micropollutants occurred in the warm core eddy; 2) particles were relatively evenly distributed across the continental shelf, although local variations did occur; and 3) the fewest number of particles were found in the Laurentian Channel.

APPENDIX 1. NOON AND MIDNIGHT POSITIONS.

DATE	TIME	LATITUDE	LONGITUDE
July 7	0000	Anchored in Tarpaulin Cove, Massachusetts	
	1200	N 41 28.00	W 70 45.00
July 8	0000	N 41 12.08	W 70 51.01
	1200	N 40 40.96	W 70 03.84
July 9	0000	N 40 26.61	W 69 05.98
	1200	N 40 14.15	W 68 12.75
July 10	0000	N 40 11.30	W 68 02.90
	1200	N 40 20.17	W 68 07.56
July 11	0000	N 40 51.30	W 68 12.06
	1200	N 41 04.08	W 68 02.36
July 12	0000	N 40 16.68	W 66 49.42
	1300	N 40 07.61	W 66 15.22
July 13	0100	N 40 36.45	W 65 18.33
	1200	N 40 55.34	W 64 22.82
July 14	0000	N 41 27.10	W 63 20.67
	1200	N 41 55.12	W 62 19.80
July 15	0000	N 42 28.09	W 61 00.45
	1200	N 42 54.51	W 59 30.11
July 16	0000	N 43 45.23	W 58 46.24
	1200	N 44 42.23	W 57 56.12
July 17	0000	N 45 26.41	W 57 19.02
	1200	N 46 21.51	W 56 41.50
July 18	0000	N 46 55.45	W 56 06.80
	1200	Dockside in Grand Bank, Newfoundland	
July 19	0000	N 47 34.50	W 56 12.00
	1200	N 47 42.30	W 56 02.49
July 20	0000	Anchored in Arran Cove, Newfoundland	
	1200	N 47 47.22	W 55 50.29
July 21	0000	Dockside in St. Albans, Newfoundland	
	1200	N 47 35.80	W 55 54.80
July 22	0000	N 47 25.44	W 56 29.92
	1200	N 46 57.90	W 57 21.41

July 23	0000	N 46 16.52	W 57 56.49
	1200	N 45 29.21	W 58 46.29
July 24	0000	N 44 55.07	W 59 21.14
	1200	Anchored off Sable Island, Canada	
July 25	0000		
	1200	N 44 09.10	W 60 20.00
July 26	0000	N 44 46.30	W 61 13.40
	1200	N 44 17.86	W 62 16.58
July 27	0000	N 44 20.39	W 62 28.09
	1200	N 44 21.57	W 63 05.73
July 28	0000	N 44 14.24	W 64 05.35
	1200	Dockside in Lunenburg, Nova Scotia	
July 29	0000		
	1200		
July 30	0000		
	1200		
July 31	0000	N 44 02.79	W 63 49.06
	1200	N 43 38.22	W 63 36.54
August 1	0000	N 43 15.06	W 64 30.59
	1200	N 42 45.31	W 65 49.79
August 2	0000	N 42 50.36	W 66 30.65
	1200	N 43 04.20	W 67 13.43
August 3	0000	N 43 23.25	W 67 53.42
	1200	N 43 44.93	W 68 34.08
August 4	0000	Dockside in Rockland, Maine	
	1200		
August 5	0000		
	1200	N 44 02.56	W 68 43.71
August 6	0000	N 43 19.98	W 67 41.45
	1200	N 44 02.56	W 68 43.71
August 7	0000	N 43 19.98	W 67 41.45
	1200	N 42 49.00	W 67 27.15
August 8	0000	N 42 42.21	W 68 17.66
	1200	N 42 47.55	W 68 53.36
August 9	0000	N 43 04.48	W 69 24.78
	1200	N 42 38.16	W 69 26.03

August 10	0000	N 42 02.79	W 70 25.29
	1200	N 41 48.16	W 70 23.07
August 11	0000	Anchored in Tarpaulin Cove, Massachusetts	

APPENDIX 2: STATION LOCATIONS

Station identification code:

SSS - Surface station salinity
SSC - Surface station chlorophyll
SSO - Surface station oxygen
SSN - Surface station nutrients
SSPH - Surface station pH
CTD - Conductivity-temperature-depth measurement
EBT - Electronic bathythermograph
MBT - Mechanical bathythermograph
OT - Otter trawl
MN - Meter net
NN - Neuston net
PN - Phytoplankton net
DN - Dip net
SG - Sediment grab
SGC - Sediment gravity core

STATION	DATE	TIME	LATITUDE	LONGITUDE
01-PN	7-7	1305	N 41 28.00	W 70 45.00
SSC-00	7-7	1305	N 41 28.00	W 70 45.00
02-SG	7-7	2105	N 41 21.26	W 71 01.73
03-SG	7-7	2117	N 41 21.07	W 71 02.64
SSS-01	7-7	2325	N 41 13.98	W 70 53.67
04-SG	7-8	0234	N 41 05.00	W 70 42.00
SSS-02	7-8	0712	N 40 50.14	W 70 16.36
SSS-03	7-8	1325	N 40 38.08	W 69 53.21
05-NN1	7-8	1603	N 40 35.00	W 69 44.00
SSS-04	7-8	2000	N 40 35.02	W 69 29.66
SSN-04	7-8	2000	N 40 35.02	W 69 29.66
SSC-04	7-8	2000	N 40 35.02	W 69 29.66
EBT-01	7-8	2100	N 40 32.80	W 69 22.20
06-NN1	7-9	0004	N 40 26.61	W 69 05.98
06-NN2	7-9	0054	N 40 26.92	W 69 07.60
SSS-05	7-9	0600	N 40 24.64	W 68 53.63
SSN-05	7-9	0600	N 40 24.64	W 68 53.63
SSC-05	7-9	0600	N 40 24.64	W 68 53.63
EBT-02	7-9	0835	N 40 21.53	W 68 36.13
SSS-06	7-9	0850	N 40 20.40	W 68 33.51
EBT-03	7-9	1037	N 40 16.81	W 68 21.13
SSS-07	7-9	1100	N 40 16.16	W 68 18.74
07-NN1	7-9	1211	N 40 13.78	W 68 11.62
07-NN2	7-9	1247	N 40 13.96	W 68 12.03
08-CTD	7-9	1603	N 40 14.01	W 68 12.50
09-NN1	7-10	0221	N 40 08.70	W 68 02.94
09-NN2	7-10	0300	N 40 09.80	W 68 02.87
10-SG	7-10	0430	N 40 10.19	W 68 02.46
11-SG	7-10	0853	N 40 16.46	W 68 00.30
EBT-04	7-10	1022	N 40 18.80	W 68 06.90
12-SG	7-10	1044	N 40 19.73	W 68 08.40
13-NN1	7-10	1227	N 40 20.90	W 68 08.70
13-NN2	7-10	1336	N 40 22.02	W 68 10.97
14-SG	7-10	1415	N 40 22.13	W 68 11.77
15-SG	7-10	1600	N 40 22.38	W 68 09.13
EBT-05	7-10	1742	N 40 25.14	W 68 10.75
16-SG	7-10	1938	N 40 29.25	W 68 08.44
EBT-06	7-10	2115	N 40 35.00	W 68 11.27
EBT-07	7-10	2205	N 40 40.85	W 68 13.45
EBT-08	7-10	2311	N 40 47.53	W 68 13.32
17-NN1	7-11	0000	N 40 51.30	W 68 12.06
17-NN2	7-11	0038	N 40 53.59	W 68 11.61
EBT-9	7-11	0015	N 40 51.64	W 68 12.06
EBT-10	7-11	0122	N 40 55.14	W 68 12.11
EBT-11	7-11	0216	N 40 50.29	W 68 15.07
EBT-12	7-11	0326	N 40 50.47	W 68 07.09
SSS-08	7-11	0326	N 40 50.47	W 68 07.09
EBT-13	7-11	0418	N 40 50.95	W 68 03.14
EBT-14	7-11	0532	N 40 53.43	W 68 03.75
SSS-09	7-11	0532	N 40 53.43	W 68 03.75
18-OT	7-11	0807	N 40 59.85	W 68 00.97
19-CTD	7-11	1000	N 41 04.11	W 68 02.99
19-NB	7-11	1000	N 41 04.11	W 68 02.99
SSC-10	7-11	1045	N 41 04.11	W 68 02.99

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SSS-10	7-11	1045	N 41 04.11	W 68 02.99
SSN-10	7-11	1045	N 41 04.11	W 68 02.99
20-NN1	7-11	1204	N 41 04.20	W 68 02.64
20-NN2	7-11	1247	N 41 04.01	W 68 04.02
EBT-15	7-11	1342	N 41 02.99	W 68 03.90
EBT-16	7-11	1446	N 40 59.75	W 67 56.06
EBT-17	7-11	1546	N 40 55.12	W 67 49.52
EBT-18	7-11	1642	N 40 50.65	W 67 43.36
EBT-19	7-11	1745	N 40 47.00	W 67 26.44
EBT-20	7-11	1850	N 40 42.46	W 67 28.71
EBT-21	7-11	1935	N 40 38,82	W 67 22.03
EBT-22	7-11	2028	N 40 34.95	W 67 15.09
EBT-23	7-11	2119	N 40 30.63	W 67 07.41
EBT-24	7-11	2159	N 40 26.74	W 67 00.63
EBT-25B	7-11	2244	N 40 23.23	W 66 54.44
EBT-26B	7-11	2330	N 40 20.08	W 66 49.76
21-MN	7-12	0517	N 40 02.20	W 66 12.60
22-DN1	7-12	0800	N 40 03.00	W 66 16.00
22-DN2	7-12	0851	N 40 04.10	W 66 17.09
22-NB	7-12	1250	N 40 07.61	W 66 15.22
22-CTD	7-12	1250	N 40 07.61	W 66 15.22
SSO-11	7-12	1356	N 40 08.10	W 66 14.06
SSS-11	7-12	1356	N 40 08.10	W 66 14.06
SSN-11	7-12	1356	N 40 08.10	W 66 14.06
SSC-11	7-12	1356	N 40 08.10	W 66 14.06
SSS-12	7-12	2116	N 40 24.63	W 65 38.82
SSO-12	7-12	2116	N 40 24.63	W 65 38.82
SSN-12	7-12	2116	N 40 24.63	W 65 38.82
23-NN1	7-13	0142	N 40 36.39	W 65 17.68
23-NN2	7-13	0220	N 40 37.46	W 65 18.99
SSN-13	7-13	0300	N 40 43.50	W 65 20.44
SSS-13	7-13	0300	N 40 43.50	W 65 20.44
SSC-13	7-13	0300	N 40 43.50	W 65 20.44
SSN-14	7-13	0524	N 40 46.18	W 65 00.75
SSS-14	7-13	0524	N 40 46.18	W 65 00.75
SSC-14	7-13	0524	N 40 46.18	W 65 00.75
SSN-15	7-13	0800	N 40 51.24	W 64 37.94
SSS-15	7-13	0800	N 40 51.24	W 64 37.94
SSC-15	7-13	0800	N 40 51.24	W 64 37.94
24-CTD	7-13	1127	N 40 55.05	W 64 24.32
24-NN1	7-13	1200	N 40 55.34	W 64 22.82
24-NN2	7-13	1231	N 40 56.72	W 64 21.42
SSS-16G	7-13	2200	N 41 20.60	W 63 35.75
SSO-16	7-13	2200	N 41 20.60	W 63 35.75
SSN-16	7-13	2200	N 41 20.60	W 63 35.75
25-CTD	7-14	0000	N 41 27.10	W 63 20.67
26-NN1	7-14	0016	N 41 27.60	W 63 19.80
26-NN2	7-14	0050	N 41 28.10	W 63 19.00
SSN-17	7-14	0330	N 41 34.30	W 63 06.63
SSS-17	7-14	0330	N 41 34.30	W 63 06.63
SSO-17	7-14	0330	N 41 34.30	W 63 06.63
SSC-17	7-14	0330	N 41 34.30	W 63 06.63
SSN-18	7-14	1015	N 41 51.48	W 62 29.61
SSC-18	7-14	1015	N 41 51.48	W 62 29.61

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SSS-18	7-14	1015	N 41 51.48	W 62 29.61
SSO-18	7-14	1015	N 41 51.48	W 62 29.61
27-CTD	7-14	1145	N 41 55.65	W 62 19.70
27-NN1	7-14	1214	N 41 55.55	W 62 19.30
27-NN2	7-14	1254	N 41 53.73	W 62 19.04
SSN-19	7-14	1600	N 41 54.35	W 62 15.03
SSS-19	7-14	1600	N 41 54.35	W 62 15.03
SSO-19	7-14	1600	N 41 54.35	W 62 15.03
SSC-19	7-14	1600	N 41 54.35	W 62 15.03
SSN-20	7-14	2200	N 42 18.09	W 61 18.09
SSS-20	7-14	2200	N 42 18.09	W 61 18.09
SSO-20	7-14	2200	N 42 18.09	W 61 18.09
SSC-20	7-14	2200	N 42 18.09	W 61 18.09
28-CTD	7-14	2345	N 42 25.27	W 61 00.74
28-NN1	7-15	0017	N 42 26.76	W 61 00.44
28-NN2	7-15	0100	N 42 28.65	W 61 00.51
SSN-21	7-15	0534	N 42 45.70	W 60 18.81
SSS-21	7-15	0534	N 42 45.70	W 60 18.81
SSO-21	7-15	0534	N 42 45.70	W 60 18.81
SSC-21	7-15	0534	N 42 45.70	W 60 18.81
SSN-22	7-15	0930	N 42 54.61	W 59 45.39
SSS-22	7-15	0930	N 42 54.61	W 59 45.39
SSO-22	7-15	0930	N 42 54.61	W 59 45.39
SSC-22	7-15	0930	N 42 54.61	W 59 45.39
MBT-25	7-15	1150	N 42 54.51	W 59 30.11
29-NN1	7-15	1210	N 43 00.27	W 59 28.59
29-NN2	7-15	1244	N 43 00.47	W 59 30.81
EBT-26	7-15	1445	N 43 05.85	W 59 29.14
SSN-23	7-15	1559	N 43 12.24	W 59 23.22
SSS-23	7-15	1559	N 43 12.24	W 59 23.22
SSO-23	7-15	1559	N 43 12.24	W 59 23.22
SSC-23	7-15	1559	N 43 12.24	W 59 23.22
EBT-27	7-15	1701	N 43 16.72	W 59 18.39
EBT-28	7-15	1909	N 43 28.11	W 59 09.72
EBT-29	7-15	2100	N 43 36.80	W 59 00.57
EBT-30	7-15	2125	N 43 38.47	W 58 58.75
MBT-31	7-15	2154	N 43 40.51	W 58 56.28
SSN-24	7-15	2200	N 43 40.51	W 58 56.28
SSS-24	7-15	2200	N 43 40.51	W 58 56.28
SSO-24	7-15	2200	N 43 40.51	W 58 56.28
SSC-24	7-15	2200	N 43 40.51	W 58 56.28
EBT-32	7-15	2254	N 43 42.9	W 58 50.86
30-NN1	7-16	0007	N 43 45.23	W 58 45.24
30-NN2	7-16	0043	N 43 45.00	W 58 43.30
EBT-33	7-16	0210	N 43 49.00	W 58 39.00
EBT-34	7-16	0634	N 44 05.44	W 58 25.13
EBT-35	7-16	1128	N 44 38.42	W 57 59.36
31-NN1	7-16	1200	N 44 43.23	W 57 55.16
SSN-25	7-16	1215	N 44 47.89	W 57 55.50
SSS-25	7-16	1215	N 44 47.89	W 57 55.50
SSO-25	7-16	1215	N 44 47.89	W 57 55.50
SSC-25	7-16	1215	N 44 47.89	W 57 55.50
31-NN2	7-16	1230	N 44 43.45	W 57 54.93
EBT-36	7-16	1454	N 44 55.97	W 57 41.94

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32-CTD	7-16	1627	N 45 03.42	W 57 33.73
SSN-26	7-16	1725	N 45 04.44	W 57 31.94
SSS-26	7-16	1725	N 45 04.44	W 57 31.94
SSO-26	7-16	1725	N 45 04.44	W 57 31.94
SSC-26	7-16	1725	N 45 04.44	W 57 31.94
33A-CTD	7-16	1945	N 45 09.30	W 57 27.28
EBT-37	7-16	2023	N 45 10.25	W 57 27.56
SSN-27	7-16	2200	N 45 16.57	W 57 24.34
SSS-27	7-16	2200	N 45 16.57	W 57 24.34
SSO-27	7-16	2200	N 45 16.57	W 57 24.34
SSC-27	7-16	2200	N 45 16.57	W 57 24.34
SST-27	7-16	2200	N 45 16.57	W 57 24.34
EBT-38	7-16	2247	N 45 20.63	W 57 22.36
32-NN1	7-17	0003	N 45 26.41	W 57 19.02
32-NN2	7-17	0036	N 45 28.89	W 57 19.45
EBT-39	7-17	0043	N 45 29.32	W 57 19.63
33B-CTD	7-17	0425	N 45 53.64	W 57 18.22
SSS-28	7-17	0600	N 45 57.34	W 57 10.73
SSO-28	7-17	0600	N 45 57.34	W 57 10.73
SSC-28	7-17	0600	N 45 57.34	W 57 10.73
SSN-28	7-17	0600	N 45 57.34	W 57 10.73
EBT-40	7-17	0708	N 46 01.50	W 57 05.97
EBT-41	7-17	0907	N 46 09.15	W 56 57.67
SSS-29	7-17	0948	N 46 45.00	W 56 15.00
SSO-29	7-17	0948	N 46 45.00	W 56 15.00
SSC-29	7-17	0948	N 46 45.00	W 56 15.00
SSN-29	7-17	0948	N 46 45.00	W 56 15.00
EBT-42	7-17	1154	N 46 21.51	W 56 41.50
EBT-43	7-17	1400	N 46 32.39	W 56 28.04
SSC-30	7-17	1600	N 46 40.47	W 56 20.54
SSS-30	7-17	1600	N 46 40.47	W 56 20.54
SSO-30	7-17	1600	N 46 40.47	W 56 20.54
SSN-30	7-17	1600	N 46 40.47	W 56 20.54
EBT-44	7-17	1600	N 46 40.47	W 56 20.54
EBT-45	7-17	1800	N 46 47.10	W 56 14.92
EBT-46	7-17	2030	N 46 51.64	W 56 09.00
34-CTD	7-18	0020	N 46 56.13	W 56 06.71
EBT-47	7-18	0206	N 46 58.52	W 56 05.05
SSC-31	7-18	0618	N 47 04.00	W 55 56.00
SSO-31	7-18	0618	N 47 04.00	W 55 56.00
SSS-31	7-18	0618	N 47 04.00	W 55 56.00
SSN-31	7-18	0618	N 47 04.00	W 55 56.00
EBT-48	7-18	1725	N 47 24.60	W 56 13.40
35-MN	7-18	1808	N 47 27.65	W 56 17.42
36-CTD	7-18	2013	N 47 32.55	W 56 17.42
36-NB	7-18	2015	N 47 32.55	W 56 17.42
36-SG	7-18	2125	N 47 33.00	W 56 16.66
37-SG	7-18	2225	N 47 33.95	W 56 12.98
37-CTD	7-18	2330	N 47 34.27	W 56 12.87
SSO-32	7-19	0040	N 47 36.20	W 56 09.87
SSS-32	7-19	0040	N 47 36.20	W 56 09.87
SSC-32	7-19	0040	N 47 36.20	W 56 09.87
SSN-32	7-19	0040	N 47 36.20	W 56 09.87
38-SG	7-19	0100	N 47 36.10	W 56 08.50

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38-CTD	7-19	0135	N 47 36.10	W 56 08.40
39-CTD	7-19	0325	N 47 41.10	W 56 05.32
39-SG	7-19	0356	N 47 41.10	W 56 05.32
40-CTD	7-19	0427	N 47 41.40	W 56 05.40
41-CTD	7-19	0527	N 47 41.90	W 56 01.80
41-SG	7-19	0558	N 47 42.10	W 56 01.60
SSC-33	7-19	0900	N 47 41.81	W 56 02.28
SSO-33	7-19	0900	N 47 41.81	W 56 02.28
SSN-33	7-19	0900	N 47 41.81	W 56 02.28
42-CTD	7-19	1252	N 47 41.90	W 56 02.30
42-NB	7-19	1300	N 47 41.90	W 56 02.30
42-SG	7-19	1346	N 47 41.33	W 56 02.77
SSS-34	7-19	1347	N 47 41.80	W 56 02.55
SSC-34	7-19	1347	N 47 41.80	W 56 02.55
SSO-34	7-19	1347	N 47 41.80	W 56 02.55
SSN-34	7-19	1347	N 47 41.80	W 56 02.55
43-SG	7-19	1427	N 47 42.89	W 56 02.35
43-CTD	7-19	1500	N 47 42.89	W 56 02.35
43-NB	7-19	1500	N 47 42.89	W 56 02.35
44-CTD	7-19	1630	N 47 42.90	W 56 02.37
45-MN	7-19	1720	N 47 44.55	W 56 02.10
46-NB	7-20	1102	N 47 47.42	W 55 50.08
SSS-35	7-20	0930	N 47 47.25	W 55 49.20
SSC-35	7-20	0930	N 47 47.25	W 55 49.20
SSN-35	7-20	0930	N 47 47.25	W 55 49.20
SSO-35	7-20	0930	N 47 47.25	W 55 49.20
SSPh-35	7-20	0930	N 47 47.25	W 55 49.20
46-CTD	7-20	1102	N 47 47.42	W 55 50.08
46-SG	7-20	1121	N 47 47.42	W 55 50.08
47-SG	7-20	1153	N 47 47.22	W 55 50.39
47-CTD	7-20	1158	N 47 47.22	W 55 50.39
47-NB	7-20	1230	N 47 47.22	W 55 50.39
48-SG	7-20	1402	N 47 54.26	W 55 46.82
SSO-36	7-20	1429	N 47 53.92	W 55 48.06
SSC-36	7-20	1429	N 47 53.92	W 55 48.06
SSN-36	7-20	1429	N 47 53.92	W 55 48.06
49-NN1	7-20	1429	N 47 53.92	W 55 48.06
SSS-37	7-21	0715	N 47 51.77	W 55 50.20
SSC-37	7-21	0715	N 47 51.77	W 55 50.20
SSPh-37	7-21	0715	N 47 51.77	W 55 50.20
SSC-38	7-21	0850	N 47 47,10	W 55 50.90
SSPh-38	7-21	0850	N 47 47.10	W 55 50.90
SSC-39	7-21	0905	N 47 44.85	W 55 52.00
SSPh-39	7-21	0905	N 47 44.85	W 55 52.00
SSC-40	7-21	0922	N 47 63.10	W 55 54.39
SSPh-40	7-21	0922	N 47 63.10	W 55 54.39
SSC-41	7-21	0953	N 47 39.63	W 55 56.19
SSPh-41	7-21	0953	N 47 39.63	W 55 56.19
SSS-42	7-21	1120	N 47 37.77	W 55 52.94
SSC-43	7-21	1145	N 47 37.04	W 55 52.60
SSPh-43	7-21	1145	N 47 37.04	W 55 52.60
50-NN1	7-21	1200	N 47 35.80	W 55 54.80
50-NN2	7-21	1241	N 47 35.30	W 55 56.50
SSC-44	7-21	1432	N 47 31.75	W 56 12.68

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SSPh-44	7-21	1432	N 47 31.75	W 56 12.68
EBT-49	7-21	1808	N 47 18.08	W 56 16.40
51-NN1	7-22	0013	N 47 25.44	W 56 29.92
51-NN2	7-22	0050	N 47 26.49	W 56 31.75
EBT-50	7-22	0330	N 47 25.16	W 56 35.33
EBT-51	7-22	0714	N 47 05.96	W 56 57.56
52-NN1	7-22	1200	N 46 57.90	W 57 21.41
52-NN2	7-22	1235	N 46 57.41	W 57 23.47
EBT-52	7-22	1300	N 46 55.10	W 57 27.21
53-CTD	7-22	1633	N 46 42.43	W 57 46.00
EBT-53	7-22	1816	N 46 38.31	W 57 50.52
54-CTD	7-22	2145	N 46 26.94	W 57 50.29
EBT-54	7-23	0310	N 46 00.00	W 58 12.00
EBT-55	7-23	0802	N 45 41.78	W 58 35.71
55-OT	7-23	0905	N 45 38.55	W 58 37.77
SSS-45	7-23	0915	N 45 30.55	W 58 37.77
SSO-45	7-23	0915	N 45 30.55	W 58 37.77
SSN-45	7-23	0915	N 45 30.55	W 58 37.77
EBT-56	7-23	1314	N 45 21.59	W 58 53.05
56-DREDGE	7-23	2030	N 45 12.88	W 59 04.95
EBT-57	7-23	2246	N 45 01.63	W 59 15.47
57-MN	7-24	0044	N 44 54.16	W 59 20.77
EBT-58	7-24	0345	N 44 39.17	W 59 32.12
EBT-59	7-24	0704	N 44 18.33	W 59 46.12
58-SG	7-24	0915	N 44 04.91	W 59 55.69
59-OT	7-24	0946	N 44 04.34	W 59 55.63
SSO-45A	7-24	2100	N 43 56.09	W 60 00.86
EBT-60	7-25	1119	N 44 06.88	W 60 14.48
60-NN1	7-25	1222	N 44 09.12	W 60 20.05
60-NN2	7-25	1305	N 44 10.39	W 60 21.78
EBT-61	7-25	1728	N 44 18.78	W 60 43.56
EBT-62	7-25	2005	N 44 30.44	W 61 00.24
61-MN	7-26	0025	N 44 47.40	W 61 13.58
EBT-63	7-26	0313	N 44 46.40	W 61 22.75
EBT-64	7-26	0720	N 44 40.19	W 61 59.65
62-SG	7-26	1159	N 44 17.53	W 62 16.79
62-NB	7-26	1159	N 44 17.53	W 62 16.79
SSS-46	7-26	1226	N 44 17.53	W 62 16.79
SSO-46	7-26	1226	N 44 17.53	W 62 16.79
SSN-46	7-26	1226	N 44 17.53	W 62 16.79
SSC-46	7-26	1226	N 44 17.53	W 62 16.79
63-OT	7-26	1313	N 44 18.62	W 62 16.19
EBT-65	7-26	1625	N 44 18.57	W 62 14.51
EBT-66	7-26	2037	N 44 16.20	W 62 18.00
64-MN	7-26	2156	N 44 18.35	W 62 22.67
64-CTD	7-26	2156	N 44 18.35	W 62 22.67
65-NN1	7-27	0004	N 44 20.39	W 62 28.09
65-NN2	7-27	0052	N 44 20.81	W 62 29.23
EBT-67	7-27	0232	N 44 22.65	W 62 32.90
EBT-68	7-27	1057	N 44 21.55	N 63 05.09
66-NN1	7-28	0009	N 44 14.12	W 64 06.31
66-NN2	7-28	0119	N 44 13.63	W 64 08.07
EBT-69	7-31	0735	N 44 33.08	W 63 05.40
67-CTD	8-1	0743	N 42 57.13	W 65 17.12

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68-CTD	8-1	1200	N 42 45.41	W 65 49.79
69-NN1	8-1	1342	N 42 46.97	W 65 53.39
69-NN2	8-1	1422	N 42 47.96	W 65 55.14
70-CTD	8-1	2352	N 42 50.12	W 66 30.11
71-NN1	8-2	0012	N 42 50.47	W 66 31.03
71-NN2	8-2	0052	N 42 51.44	W 66 34.10
72-CTD	8-2	0530	N 43 04.18	W 67 05.02
73-NN1	8-2	1305	N 43 05.76	W 67 16.69
73-NN2	8-2	1345	N 43 06.89	W 67 16.92
74-CTD	8-2	2113	N 43 17.86	W 67 42.95
75-NN1	8-3	0000	N 43 23.25	W 67 53.42
75-NN2	8-3	0055	N 43 24.72	W 67 55.41
76-CTD	8-3	0400	N 43 35.89	W 68 16.69
77-NN1	8-3	1200	N 43 44.93	W 68 34.08
77-NN2	8-3	1235	N 43 45.40	W 68 33.67
78-CTD	8-3	1351	N 43 45.53	W 68 34.78
79-SCO	8-8	1700	N 42 56.42	W 68 44.04

08-CTD	7-9	1603	N 40 14.01	W 68 12.50
19-CTD	7-11	1000	N 41 04.11	W 68 02.99
22-CTD	7-12	1250	N 40 07.61	W 66 15.22
24-CTD	7-13	1127	N 40 55.05	W 64 24.32
25-CTD	7-14	0000	N 41 27.10	W 63 20.67
27-CTD	7-14	1145	N 41 55.65	W 62 19.70
28-CTD	7-14	2345	N 42 25.27	W 61 00.74
32-CTD	7-16	1627	N 45 03.42	W 57 33.73
34-CTD	7-18	0020	N 46 56.13	W 56 06.71
36-CTD	7-18	2013	N 47 32.55	W 56 17.42
37-CTD	7-18	2330	N 47 34.27	W 56 12.87
38-CTD	7-19	0135	N 47 36.10	W 56 08.40
39-CTD	7-19	0325	N 47 41.10	W 56 05.32
40-CTD	7-19	0427	N 47 41.40	W 56 05.40
41-CTD	7-19	0527	N 47 41.90	W 56 01.80
42-CTD	7-19	1252	N 47 41.90	W 56 02.30
43-CTD	7-19	1500	N 47 42.89	W 56 02.35
44-CTD	7-19	1630	N 47 42.90	W 56 02.37
46-CTD	7-20	1102	N 47 47.42	W 55 50.08
47-CTD	7-20	1158	N 47 47.22	W 55 50.39
53-CTD	7-22	1633	N 46 42.43	W 57 46.00
54-CTD	7-22	2145	N 46 26.94	W 57 50.29
64-CTD	7-26	2156	N 44 18.35	W 62 22.67
67-CTD	8-1	0743	N 42 57.13	W 65 17.12
68-CTD	8-1	1200	N 42 45.41	W 65 49.79
70-CTD	8-1	2352	N 42 50.12	W 66 30.11
72-CTD	8-2	0530	N 43 04.18	W 67 05.02
74-CTD	8-2	2113	N 43 17.86	W 67 42.95
76-CTD	8-3	0400	N 43 35.89	W 68 16.69
78-CTD	8-3	1351	N 43 45.53	W 68 34.78

EBT-01	7-8	2100	N 40 32.80	W 69 22.20
EBT-02	7-9	0835	N 40 21.53	W 68 36.13
EBT-03	7-9	1037	N 40 16.81	W 68 21.13

STATION	DATE	TIME	LATITUDE	LONGITUDE
EBT-04	7-10	1022	N 40 18.80	W 68 06.90
EBT-05	7-10	1742	N 40 25.14	W 68 10.75
EBT-06	7-10	2115	N 40 35.00	W 68 11.27
EBT-07	7-10	2205	N 40 40.85	W 68 13.45
EBT-08	7-10	2311	N 40 47.53	W 68 13.32
EBT-09	7-11	0015	N 40 51.64	W 68 12.16
EBT-10	7-11	0122	N 40 55.14	W 68 12.11
EBT-11	7-11	0216	N 40 50.29	W 68 15.07
EBT-12	7-11	0326	N 40 50.47	W 68 07.09
EBT-13	7-11	0418	N 40 50.95	W 68 03.14
EBT-14	7-11	0532	N 40 53.43	W 68 03.75
EBT-15	7-11	1342	N 41 02.99	W 68 03.90
EBT-16	7-11	1446	N 40 59.75	W 67 56.06
EBT-17	7-11	1546	N 40 55.12	W 67 49.52
EBT-18	7-11	1642	N 40 50.65	W 67 43.36
EBT-19	7-11	1745	N 40 47.00	W 67 26.44
EBT-20	7-11	1850	N 40 42.46	W 67 28.71
EBT-21	7-11	1935	N 40 38.82	W 67 22.03
EBT-22	7-11	2028	N 40 34.95	W 67 15.09
EBT-23	7-11	2119	N 40 30.63	W 67 07.41
EBT-24	7-11	2159	N 40 26.74	W 67 00.63
EBT-25B	7-11	2244	N 40 23.23	W 66 54.44
EBT-26B	7-11	2330	N 40 20.08	W 66 49.76
MBT-25	7-15	1150	N 42 54.51	W 59 30.11
EBT-26	7-15	1445	N 43 05.85	W 59 29.14
EBT-27	7-15	1701	N 43 16.72	W 59 18.39
EBT-28	7-15	1909	N 43 28.11	W 59 09.72
EBT-29	7-15	2100	N 43 36.80	W 59 00.57
EBT-30	7-15	2125	N 43 38.47	W 58 58.75
MBT-31	7-15	2154	N 43 40.51	W 58 56.28
EBT-32	7-15	2254	N 43 42.90	W 58 50.86
EBT-33	7-16	0210	N 43 49.00	W 58 39.00
EBT-34	7-16	0634	N 44 05.44	W 58 25.13
EBT-35	7-16	1128	N 44 38.42	W 57 59.36
EBT-36	7-16	1454	N 44 55.97	W 57 41.94
EBT-37	7-16	2023	N 45 10.25	W 57 27.56
EBT-38	7-16	2247	N 45 20.63	W 57 22.36
EBT-39	7-17	0043	N 45 29.32	W 57 19.63
EBT-40	7-17	0708	N 46 01.50	W 57 05.97
EBT-41	7-17	0907	N 46 09.15	W 56 57.67
EBT-42	7-17	1154	N 46 21.51	W 56 41.50
EBT-43	7-17	1400	N 46 32.39	W 56 28.04
EBT-44	7-17	1600	N 46 40.47	W 56 20.54
EBT-45	7-17	1800	N 46 47.10	W 56 14.92
EBT-46	7-17	2030	N 46 51.64	W 56 09.00
EBT-47	7-18	0206	N 46 58.52	W 56 05.05
EBT-48	7-18	1725	N 47 24.60	W 56 13.40
EBT-49	7-21	1808	N 47 18.08	W 56 16.40
EBT-50	7-22	0330	N 47 25.16	W 56 35.33
EBT-51	7-22	0714	N 47 05.96	W 56 57.56
EBT-52	7-22	1300	N 46 55.10	W 57 27.21
EBT-53	7-22	1816	N 46 38.31	W 57 50.52
EBT-54	7-23	0310	N 46 00.00	W 58 12.00
EBT-55	7-23	0802	N 45 41.78	W 58 35.71

STATION	DATE	TIME	LATITUDE	LONGITUDE
EBT-56	7-23	1314	N 45 21.59	W 58 53.05
EBT-57	7-23	2246	N 45 01.63	W 59 15.47
EBT-58	7-24	0345	N 44 39.17	W 59 32.12
EBT-59	7-24	0704	N 44 18.33	W 59 46.12
EBT-60	7-25	1119	N 44 06.88	W 60 14.48
EBT-61	7-25	1728	N 44 18.78	W 60 43.56
EBT-62	7-25	2005	N 44 30.44	W 61 00.24
EBT-63	7-26	0313	N 44 46.40	W 61 22.75
EBT-64	7-26	0720	N 44 40.19	W 61 59.65
EBT-65	7-26	1625	N 44 18.57	W 62 14.51
EBT-66	7-26	2037	N 44 16.20	W 62 18.00
EBT-67	7-27	0232	N 44 22.65	W 62 32.90
EBT-68	7-27	1057	N 44 21.55	N 63 05.09
EBT-69	7-31	0735	N 44 33.08	W 63 05.40
05-NN1	7-8	1603	N 40 35.00	W 69 44.00
06-NN1	7-9	0004	N 40 26.61	W 69 05.98
06-NN2	7-9	0054	N 40 26.92	W 69 07.60
07-NN1	7-9	1211	N 40 13.78	W 68 11.62
07-NN2	7-9	1247	N 40 13.96	W 68 12.03
09-NN1	7-10	0221	N 40 08.70	W 68 02.94
09-NN2	7-10	0300	N 40 09.80	W 68 02.87
13-NN1	7-10	1227	N 40 20.90	W 68 08.70
13-NN2	7-10	1336	N 40 22.02	W 68 10.97
17-NN1	7-11	0000	N 40 51.30	W 68 12.06
17-NN2	7-11	0038	N 40 53.59	W 68 11.61
20-NN1	7-11	1204	N 41 04.20	W 68 02.64
20-NN2	7-11	1247	N 41 04.01	W 68 04.02
23-NN1	7-13	0142	N 40 36.39	W 65 17.68
23-NN2	7-13	0220	N 40 37.46	W 65 18.99
24-NN1	7-13	1200	N 40 55.34	W 64 22.82
24-NN2	7-13	1231	N 40 56.72	W 64 21.42
26-NN1	7-14	0016	N 41 27.60	W 63 19.80
26-NN2	7-14	0050	N 41 28.10	W 63 19.00
27-NN1	7-14	1214	N 41 55.55	W 62 19.30
27-NN2	7-14	1254	N 41 53.73	W 62 19.04
28-NN1	7-15	0017	N 42 26.76	W 61 00.44
28-NN2	7-15	0100	N 42 28.65	W 61 00.51
29-NN1	7-15	1210	N 43 00.27	W 59 28.59
29-NN2	7-15	1244	N 43 00.47	W 59 30.81
30-NN1	7-16	0007	N 43 45.23	W 58 45.24
30-NN2	7-16	0043	N 43 45.00	W 58 43.30
31-NN1	7-16	1200	N 44 43.23	W 57 55.16
31-NN-2	7-16	1230	N 44 43.45	W 57 54.93
32-NN1	7-17	0003	N 45 26.41	W 57 19.02
32-NN2	7-17	0036	N 45 28.89	W 57 19.45
49-NN1	7-20	1429	N 47 53.92	W 55 48.06
50-NN1	7-21	1200	N 47 35.80	W 55 54.80
50-NN2	7-21	1241	N 47 35.30	W 55 56.50
51-NN1	7-22	0013	N 47 25.44	W 56 29.92
51-NN2	7-22	0050	N 47 26.49	W 56 31.75
52-NN1	7-22	1200	N 46 57.90	W 57 21.41
52-NN2	7-22	1235	N 46 57.41	W 57 23.47

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60-NN1	7-25	1222	N 44 09.12	W 60 20.05
60-NN2	7-25	1305	N 44 10.39	W 60 21.78
65-NN1	7-27	0004	N 44 20.39	W 62 28.09
65-NN2	7-27	0052	N 44 20.81	W 62 29.23
66-NN1	7-28	0009	N 44 14.12	W 64 06.31
66-NN2	7-28	0119	N 44 13.63	W 64 08.07
69-NN1	8-1	1342	N 42 46.97	W 65 53.39
69-NN2	8-1	1422	N 42 47.96	W 65 55.14
71-NN1	8-2	0012	N 42 50.47	W 66 31.03
71-NN2	8-2	0052	N 42 51.44	W 66 34.10
73-NN1	8-2	1305	N 43 05.76	W 67 16.69
73-NN2	8-2	1345	N 43 06.89	W 67 16.92
75-NN1	8-3	0000	N 43 23.25	W 67 53.42
75-NN2	8-3	0055	N 43 24.72	W 67 55.41
77-NN1	8-3	1200	N 43 44.93	W 68 34.08
77-NN2	8-3	1235	N 43 45.40	W 68 33.67
SSS-01	7-7	2325	N 41 13.98	W 70 53.67
SSS-02	7-8	0712	N 40 50.14	W 70 16.36
SSS-03	7-8	1325	N 40 38.08	W 69 53.21
SSS-04	7-8	2000	N 40 35.02	W 69 29.66
SSS-05	7-9	0600	N 40 24.64	W 68 53.63
SSS-06	7-9	0850	N 40 20.40	W 68 33.51
SSS-07	7-9	1100	N 40 16.16	W 68 18.74
SSS-08	7-11	0326	N 40 50.47	W 68 07.09
SSS-09	7-11	0532	N 40 53.43	W 68 03.75
SSS-10	7-11	1045	N 41 04.11	W 68 02.99
SSS-11	7-12	1356	N 40 08.10	W 66 14.06
SSS-12	7-12	2116	N 40 24.63	W 65 38.82
SSS-13	7-13	0300	N 40 43.50	W 65 20.44
SSS-14	7-13	0524	N 40 46.18	W 65 00.75
SSS-15	7-13	0800	N 40 51.24	W 64 37.94
SSS-16G	7-13	2200	N 41 20.60	W 63 35.75
SSS-17	7-14	0330	N 41 34.30	W 63 06.63
SSS-18	7-14	1015	N 41 51.48	W 62 29.61
SSS-19	7-14	1600	N 41 54.35	W 62 15.03
SSS-20	7-14	2200	N 42 18.09	W 61 18.09
SSS-21	7-15	0534	N 42 45.70	W 60 18.81
SSS-22	7-15	0930	N 42 54.61	W 59 45.39
SSS-23	7-15	1559	N 43 12.24	W 59 23.22
SSS-24	7-15	2200	N 43 40.51	W 58 56.28
SSS-25	7-16	1215	N 44 47.89	W 57 55.50
SSS-26	7-16	1725	N 45 04.44	W 57 31.94
SSS-27	7-16	2200	N 45 16.57	W 57 24.34
SSS-28	7-17	0600	N 45 57.34	W 57 10.73
SSS-29	7-17	0948	N 46 45.00	W 56 15.00
SSS-30	7-17	1600	N 46 40.47	W 56 20.54
SSS-31	7-18	0618	N 47 04.00	W 55 56.00
SSS-32	7-19	0040	N 47 36.20	W 56 09.87
SSS-34	7-19	1347	N 47 41.80	W 56 02.55
SSS-35	7-20	0930	N 47 47.25	W 55 49.20
SSS-37	7-21	0715	N 47 51.77	W 55 50.20
SSS-42	7-21	1120	N 47 37.77	W 55 52.94

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SSS-45	7-23	0915	N 45 30.55	W 58 37.77
SSS-46	7-26	1226	N 44 17.53	W 62 16.79
SSO-11	7-12	1356	N 40 08.10	W 66 14.06
SSO-12	7-12	2116	N 40 24.63	W 65 38.82
SSO-16	7-13	2200	N 41 20.60	W 63 35.75
SSO-17	7-14	0330	N 41 34.30	W 63 06.63
SSO-18	7-14	1015	N 41 51.48	W 62 29.61
SSO-19	7-14	1600	N 41 54.35	W 62 15.03
SSO-20	7-14	2200	N 42 18.09	W 61 18.09
SSO-21	7-15	0534	N 42 45.70	W 60 18.81
SSO-22	7-15	0930	N 42 54.61	W 59 45.39
SSO-23	7-15	1559	N 43 12.24	W 59 23.22
SSO-25	7-16	1215	N 44 47.89	W 57 55.50
SSO-26	7-16	1725	N 45 04.44	W 57 31.94
SSO-27	7-16	2200	N 45 16.57	W 57 24.34
SSO-28	7-17	0600	N 45 57.34	W 57 10.73
SSO-29	7-17	0948	N 46 45.00	W 56 15.00
SSO-30	7-17	1600	N 46 40.47	W 56 20.54
SSO-31	7-18	0618	N 47 04.00	W 55 56.00
SSO-32	7-19	0040	N 47 36.20	W 56 09.87
SSO-33	7-19	0900	N 47 41.81	W 56 02.28
SSO-34	7-19	1347	N 47 41.80	W 56 02.55
SSO-35	7-20	0930	N 47 47.25	W 55 49.20
SSO-45	7-23	0915	N 45 30.55	W 58 37.77
SSO-45A	7-24	2100	N 43 56.09	W 60 00.86
SSO-46	7-26	1226	N 44 17.53	W 62 16.79
SSC-00	7-7	1305	N 41 28.00	W 70 45.00
SSC-04	7-8	2000	N 40 35.02	W 69 29.66
SSC-05	7-9	0600	N 40 24.64	W 68 53.63
SSC-10	7-11	1045	N 41 04.11	W 68 02.99
SSC-11	7-12	1356	N 40 08.10	W 66 14.06
SSC-13	7-13	0300	N 40 43.50	W 65 20.44
SSC-14	7-13	0524	N 40 46.18	W 65 00.75
SSC-15	7-13	0800	N 40 51.24	W 64 37.94
SSC-17	7-14	0330	N 41 34.30	W 63 06.63
SSC-18	7-14	1015	N 41 51.48	W 62 29.61
SSC-19	7-14	1600	N 41 54.35	W 62 15.03
SSC-20	7-14	2200	N 42 18.09	W 61 18.09
SSC-21	7-15	0534	N 42 45.70	W 60 18.81
SSC-22	7-15	0930	N 42 54.61	W 59 45.39
SSC-23	7-15	1559	N 43 12.24	W 59 23.22
SSC-24	7-15	2200	N 43 40.51	W 58 56.28
SSC-25	7-16	1215	N 44 47.89	W 57 55.50
SSC-26	7-16	1725	N 45 04.44	W 57 31.94
SSC-27	7-16	2200	N 45 16.57	W 57 24.34
SSC-28	7-17	0600	N 45 57.34	W 57 10.73
SSC-29	7-17	0948	N 46 45.00	W 56 15.00
SSC-30	7-17	1600	N 46 40.47	W 56 20.54
SSC-31	7-18	0618	N 47 04.00	W 55 56.00
SSC-32	7-19	0040	N 47 36.20	W 56 09.87

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SSC-33	7-19	0900	N 47 41.81	W 56 02.28
SSC-34	7-19	1347	N 47 41.80	W 56 02.55
SSC-35	7-20	0930	N 47 47.25	W 55 49.20
SSC-36	7-20	1429	N 47 53.92	W 55 48.06
SSC-37	7-21	0715	N 47 51.77	W 55 50.20
SSC-38	7-21	0850	N 47 47.10	W 55 50.90
SSC-39	7-21	0905	N 47 44.85	W 55 52.00
SSC-40	7-21	0922	N 47 63.10	W 55 54.39
SSC-41	7-21	0953	N 47 39.63	W 55 56.19
SSC-43	7-21	1145	N 47 37.04	W 55 52.60
SSC-44	7-21	1432	N 47 31.75	W 56 12.68
SSC-46	7-26	1226	N 44 17.53	W 62 16.79
SSN-04	7-8	2000	N 40 35.02	W 69 29.66
SSN-05	7-9	0600	N 40 24.64	W 68 53.63
SSN-10	7-11	1045	N 41 04.11	W 68 02.99
SSN-11	7-12	1356	N 40 08.10	W 66 14.06
SSN-12	7-12	2116	N 40 24.63	W 65 38.82
SSN-13	7-13	0300	N 40 43.50	W 65 20.44
SSN-14	7-13	0524	N 40 46.18	W 65 00.75
SSN-15	7-13	0800	N 40 51.24	W 64 37.94
SSN-16	7-13	2200	N 41 20.60	W 63 35.75
SSN-17	7-14	0330	N 41 34.30	W 63 06.63
SSN-18	7-14	1015	N 41 51.48	W 62 29.61
SSN-19	7-14	1600	N 41 54.35	W 62 15.03
SSN-20	7-14	2200	N 42 18.09	W 61 18.09
SSN-21	7-15	0534	N 42 45.70	W 60 18.81
SSN-22	7-15	0930	N 42 54.61	W 59 45.39
SSN-23	7-15	1559	N 43 12.24	W 59 23.22
SSN-24	7-15	2200	N 43 40.51	W 58 56.28
SSN-25	7-16	1215	N 44 47.89	W 57 55.50
SSN-26	7-16	1725	N 45 04.44	W 57 31.94
SSN-27	7-16	2200	N 45 16.57	W 57 24.34
SSN-28	7-17	0600	N 45 57.34	W 57 10.73
SSN-29	7-17	0948	N 46 45.00	W 56 15.00
SSN-30	7-17	1600	N 46 40.47	W 56 20.54
SSN-31	7-18	0618	N 47 04.00	W 55 56.00
SSN-32	7-19	0040	N 47 36.20	W 56 09.87
SSN-33	7-19	0900	N 47 41.81	W 56 02.28
SSN-34	7-19	1347	N 47 41.80	W 56 02.55
SSN-35	7-20	0930	N 47 47.25	W 55 49.20
19-NB	7-11	1000	N 41 04.11	W 68 02.99
22-NB	7-12	1250	N 40 07.61	W 66 15.22
36-NB	7-18	2015	N 47 32.55	W 56 17.42
42-NB	7-19	1300	N 47 41.90	W 56 02.30
43-NB	7-19	1500	N 47 42.89	W 56 02.35
46-NB	7-20	1102	N 47 47.42	W 55 50.08
47-NB	7-20	1230	N 47 47.22	W 55 50.39
62-NB	7-26	1159	N 44 17.53	W 62 16.79

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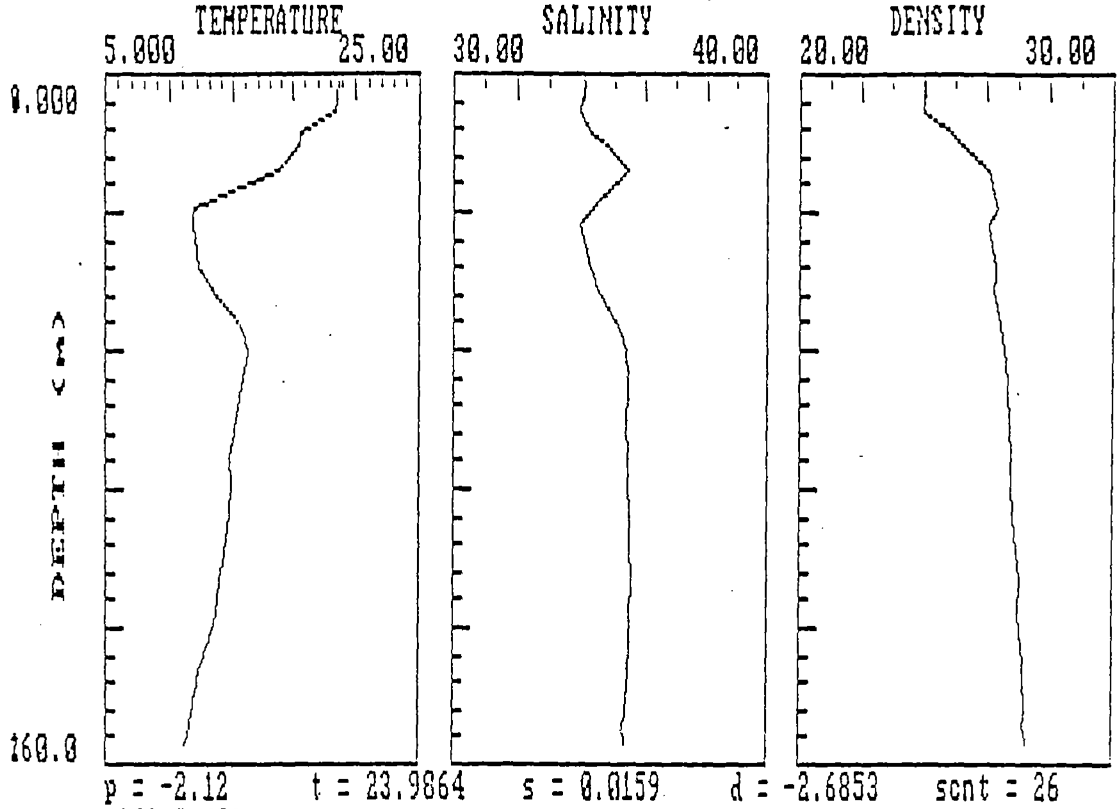
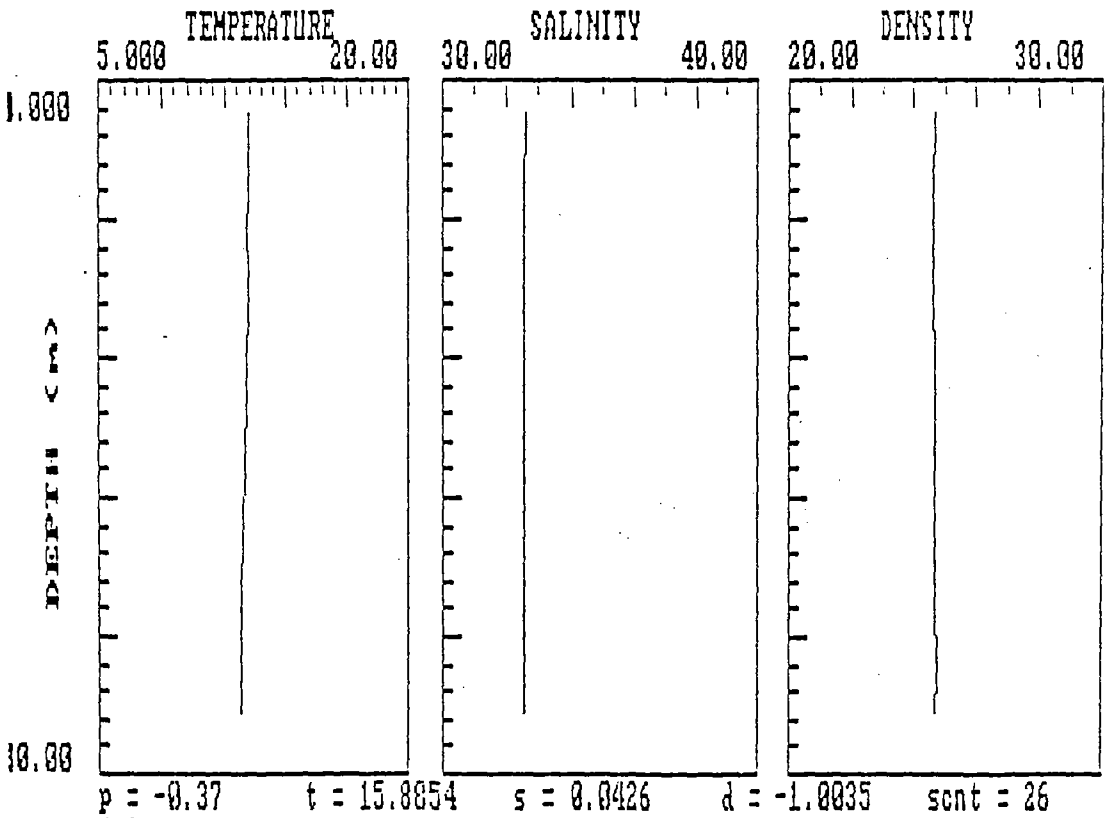
02-SG	7-7	2105	N 41 21.26	W 71 01.73
03-SG	7-7	2117	N 41 21.07	W 71 02.64
04-SG	7-8	0234	N 41 05.00	W 70 42.00
10-SG	7-10	0430	N 40 10.19	W 68 02.46
11-SG	7-10	0853	N 40 16.46	W 68 00.30
12-SG	7-10	1044	N 40 19.73	W 68 08.40
14-SG	7-10	1415	N 40 22.13	W 68 11.77
15-SG	7-10	1600	N 40 22.38	W 68 09.13
16-SG	7-10	1938	N 40 29.25	W 68 08.44
36-SG	7-18	2125	N 47 33.00	W 56 16.66
37-SG	7-18	2225	N 47 33.95	W 56 12.98
38-SG	7-19	0100	N 47 36.10	W 56 08.50
39-SG	7-19	0356	N 47 41.10	W 56 05.32
41-SG	7-19	0558	N 47 42.10	W 56 01.60
42-SG	7-19	1346	N 47 41.33	W 56 02.77
43-SG	7-19	1427	N 47 42.89	W 56 02.35
46-SG	7-20	1121	N 47 47.42	W 55 50.08
47-SG	7-20	1153	N 47 47.22	W 55 50.39
48-SG	7-20	1402	N 47 54.26	W 55 46.82
56-DREDGE	7-23	2030	N 45 12.88	W 59 04.95
58-SG	7-24	0915	N 44 04.91	W 59 55.69
62-SG	7-26	1159	N 44 17.53	W 62 16.79
79-SCO	8-8	1700	N 42 56.42	W 68 44.04
18-OT	7-11	0807	N 40 59.85	W 68 00.47
55-OT	7-23	0905	N 45 38.55	W 58 37.77
59-OT	7-24	0946	N 44 04.34	W 59 55.03
63-OT	7-26	1313	N 44 18.62	W 62 16.19
01-PN	7-7	1305	N 41 28.00	W 70 45.00
22-DN1	7-12	0800	N 40 03.00	W 66 16.00
22-DN2	7-12	0851	N 40 04.10	W 66 17.09
21-MN	7-12	0517	N 40 02.20	W 66 12.60
35-MN	7-18	1808	N 47 27.65	W 56 17.42
45-MN	7-19	1720	N 47 44.55	W 56 02.10
57-MN	7-24	0044	N 44 54.16	W 59 20.77
61-MN	7-26	0025	N 44 47.40	W 61 13.58
64-MN	7-26	2156	N 44 18.35	W 62 22.67

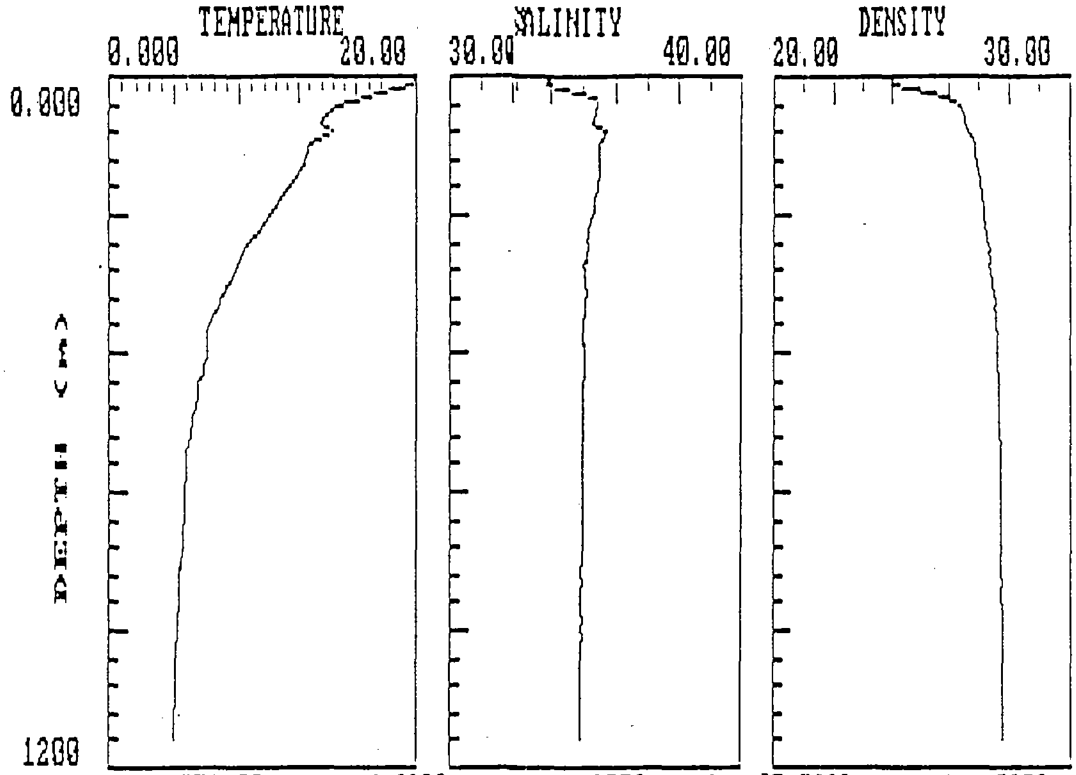
Appendix 3: conductivity-temperature-depth measurements



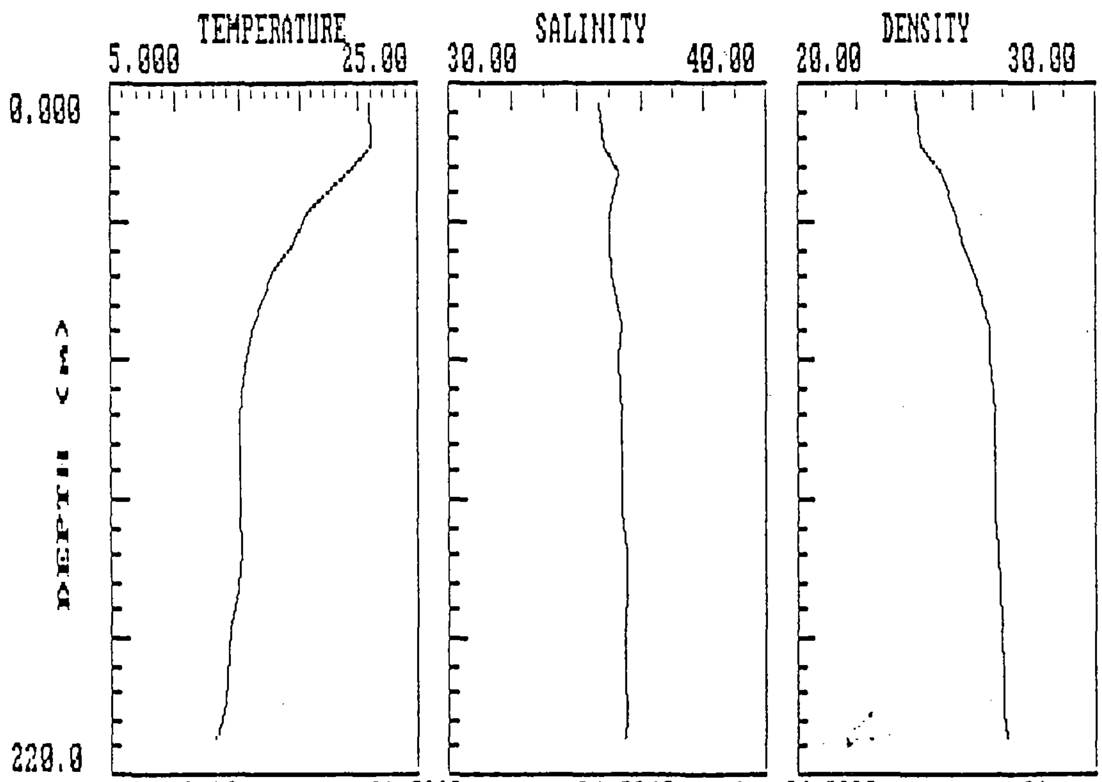
C101-8-CTD



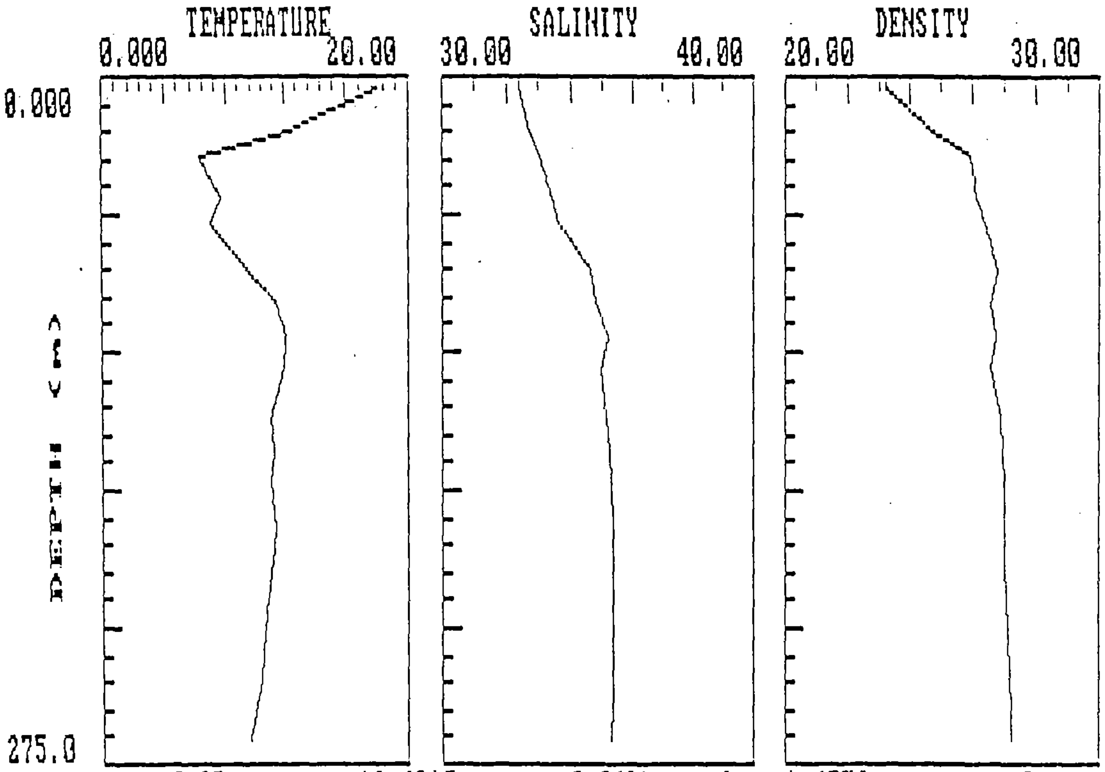
C101-19-CTD



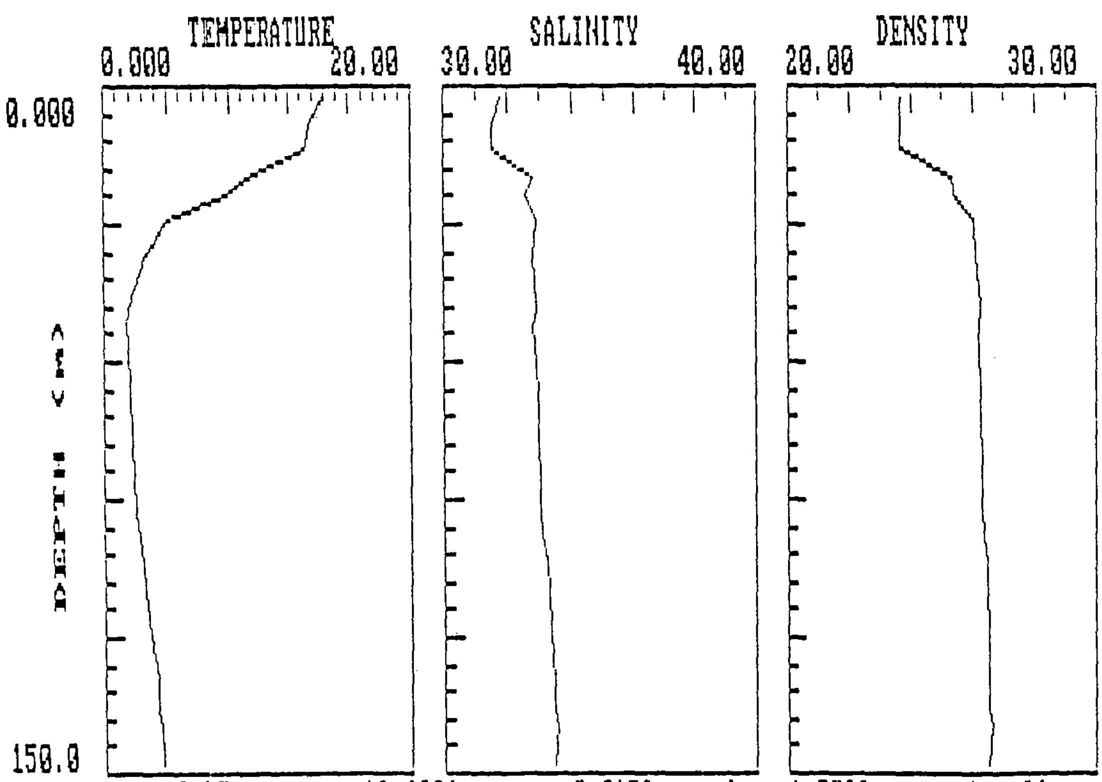
p = 1071.70 t = 4.0823 s= 34.9773 d = 27.7683 scnt = 5278
C-101-22-CTD



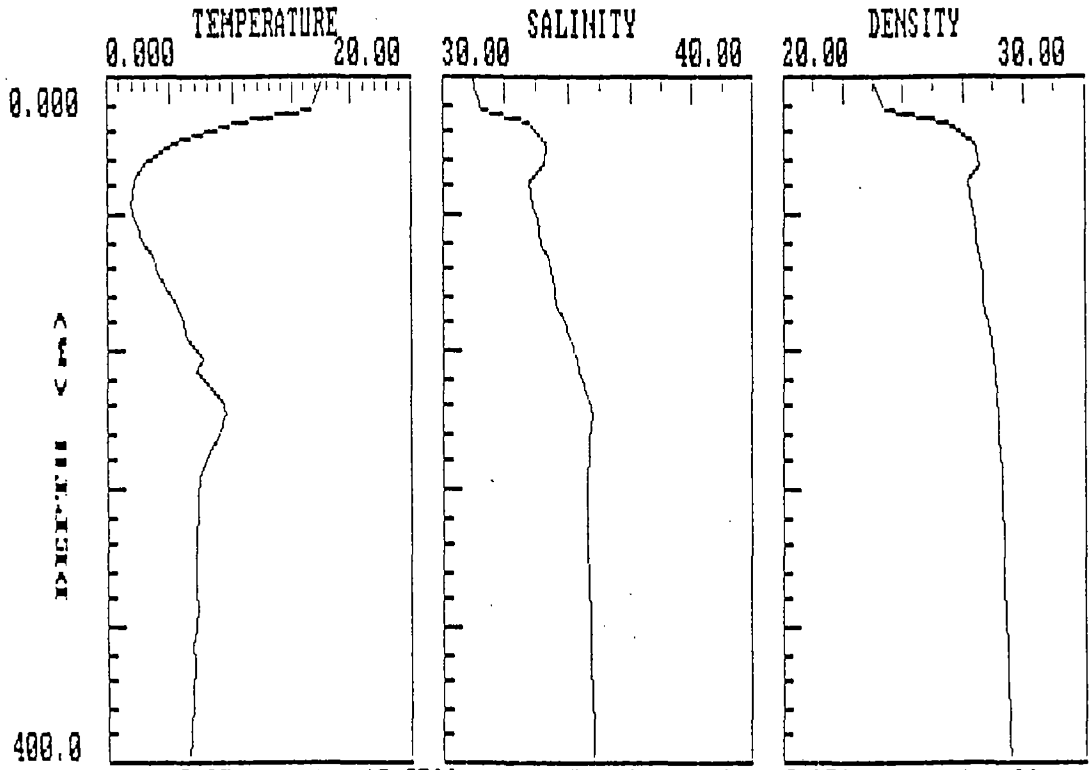
p = -2.12 t = 21.7862 s = 34.7240 d = 24.0690 scnt = 26
C101-24-CTD



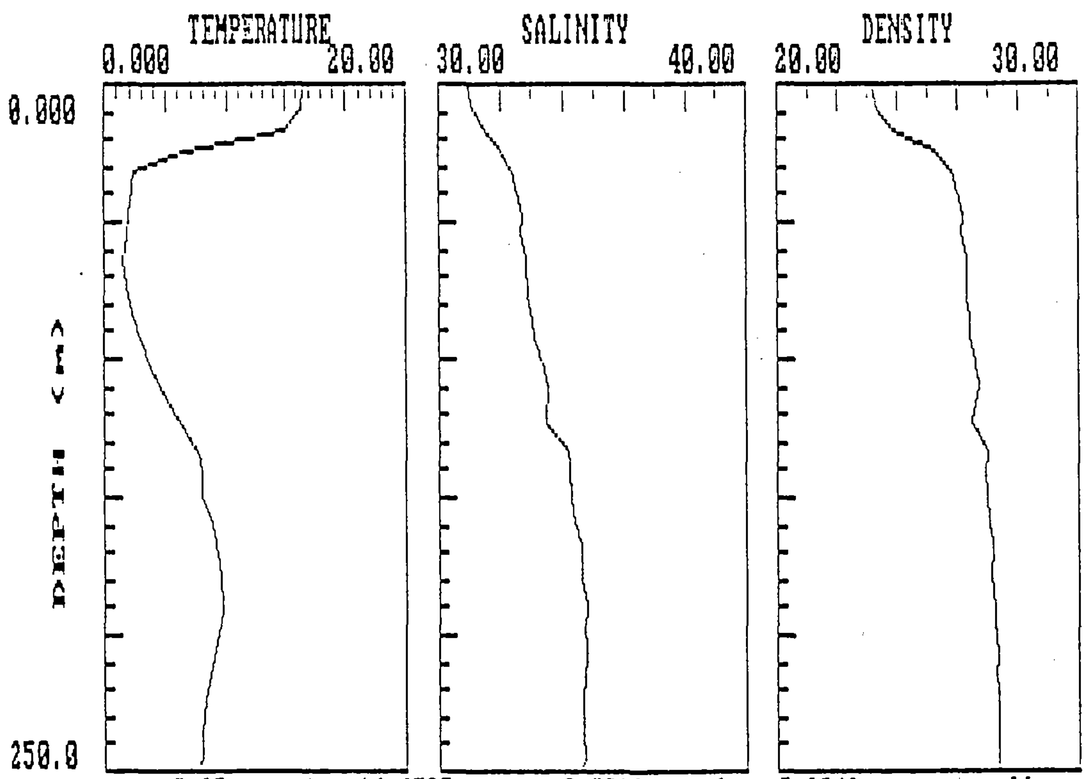
p = -0.37 t = 18.4915 s = 0.0481 d = -1.4576 scnt = 26
C101-27-CTD



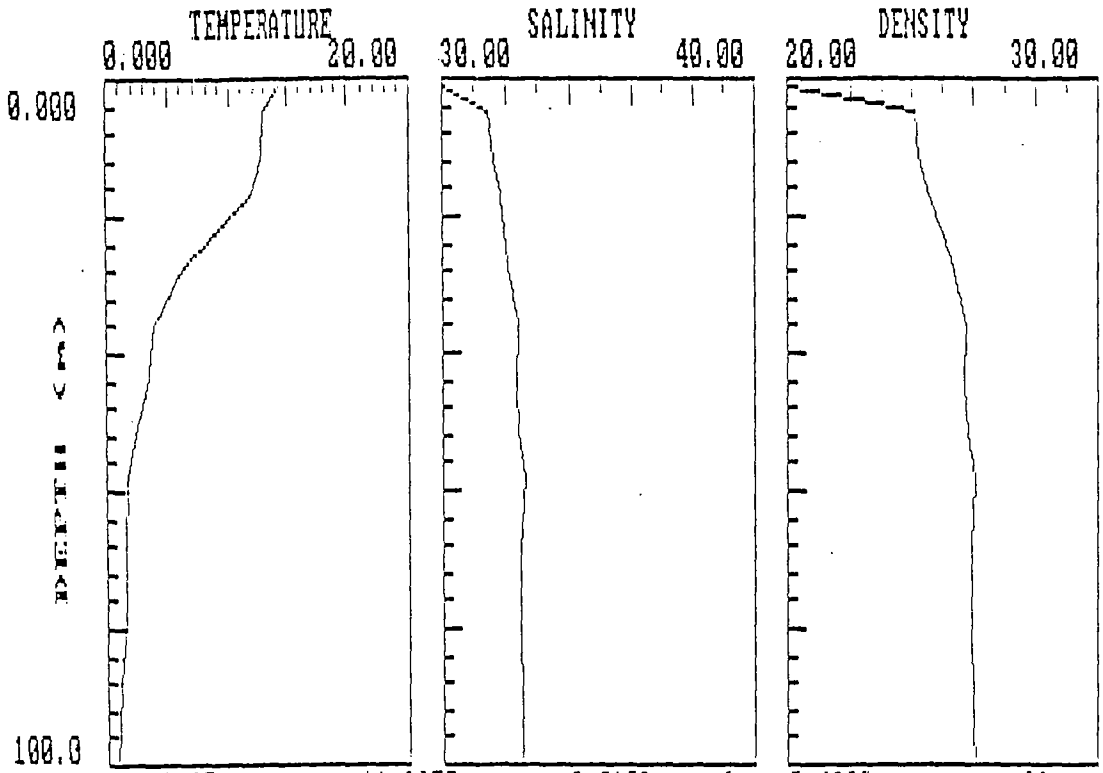
p = -0.37 t = 18.6381 s = 0.0172 d = -1.5093 scnt = 26
C101-32-CTD



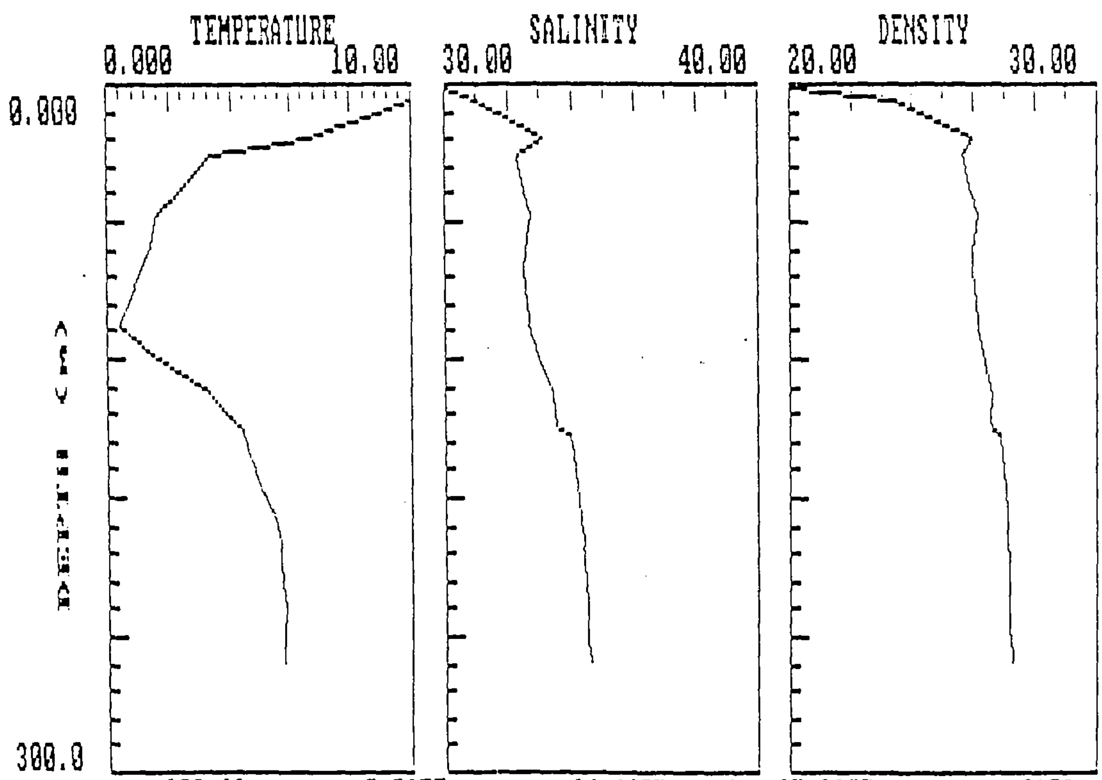
p = -0.37 t = 15.5766 s = 0.0144 d = -0.9762 scnt = 26
C101-33A-CTD



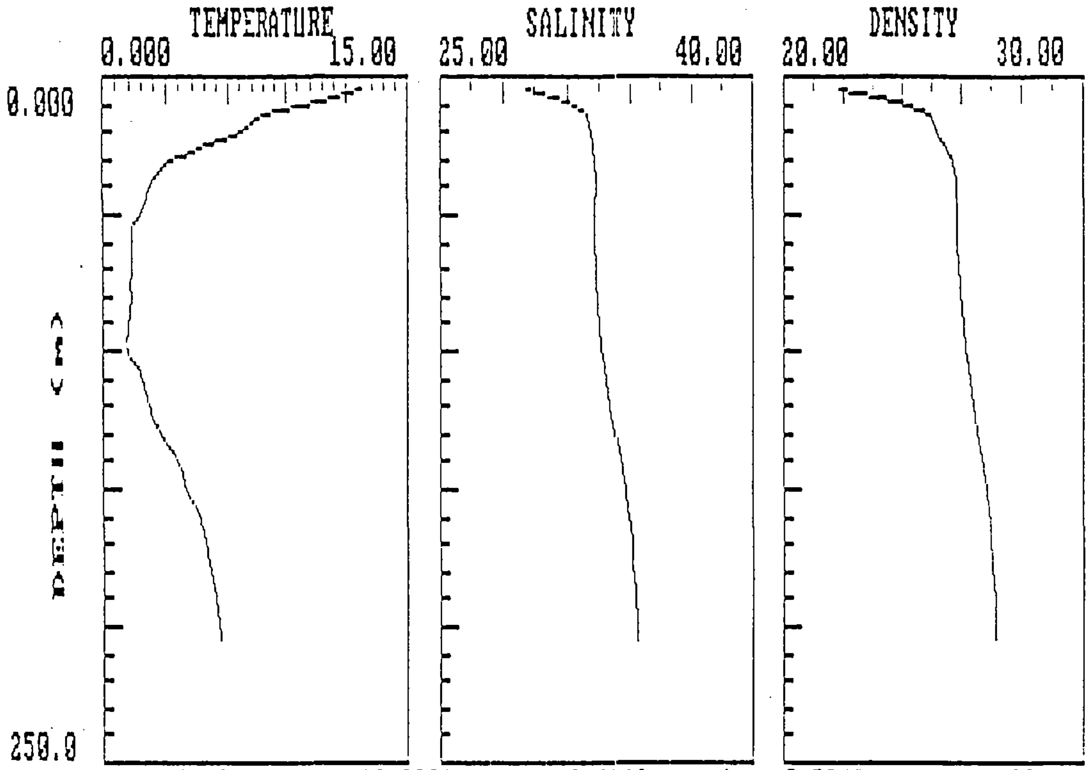
p = -0.37 t = 14.4787 s = 0.0216 d = -0.8046 scnt = 26
C101-33B-CTD



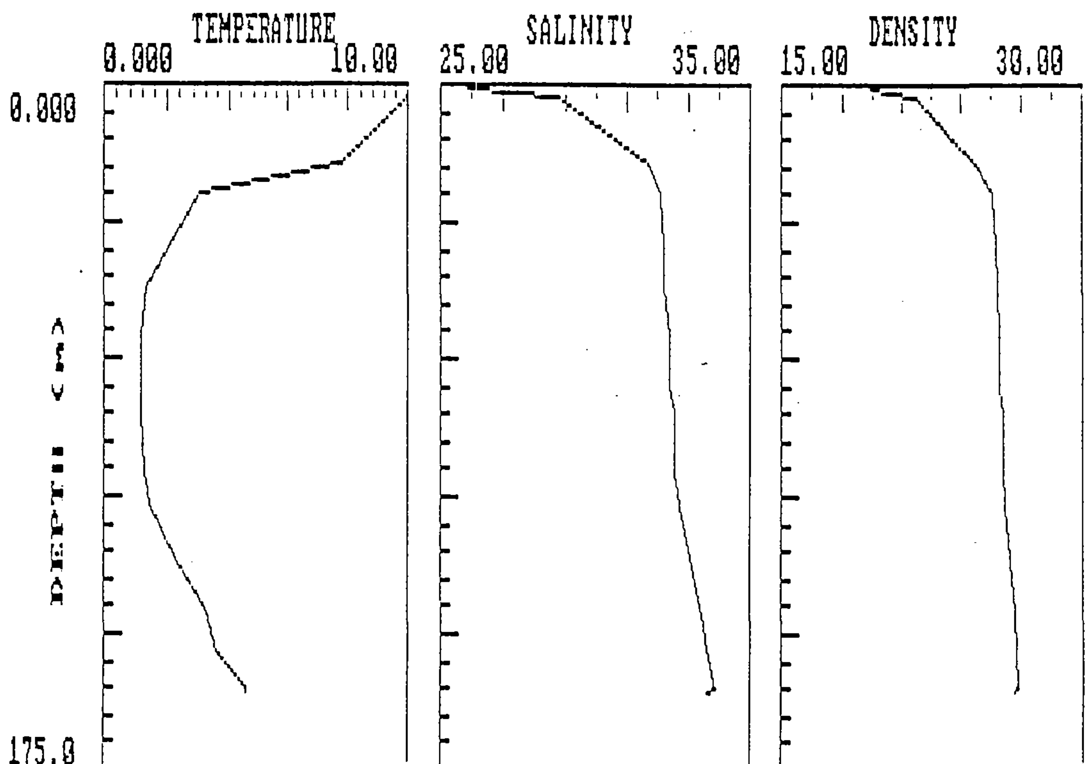
p = 1.37 t = 11.3650 s = 0.0103 d = -0.4223 scnt = 26
C101-34-CTD



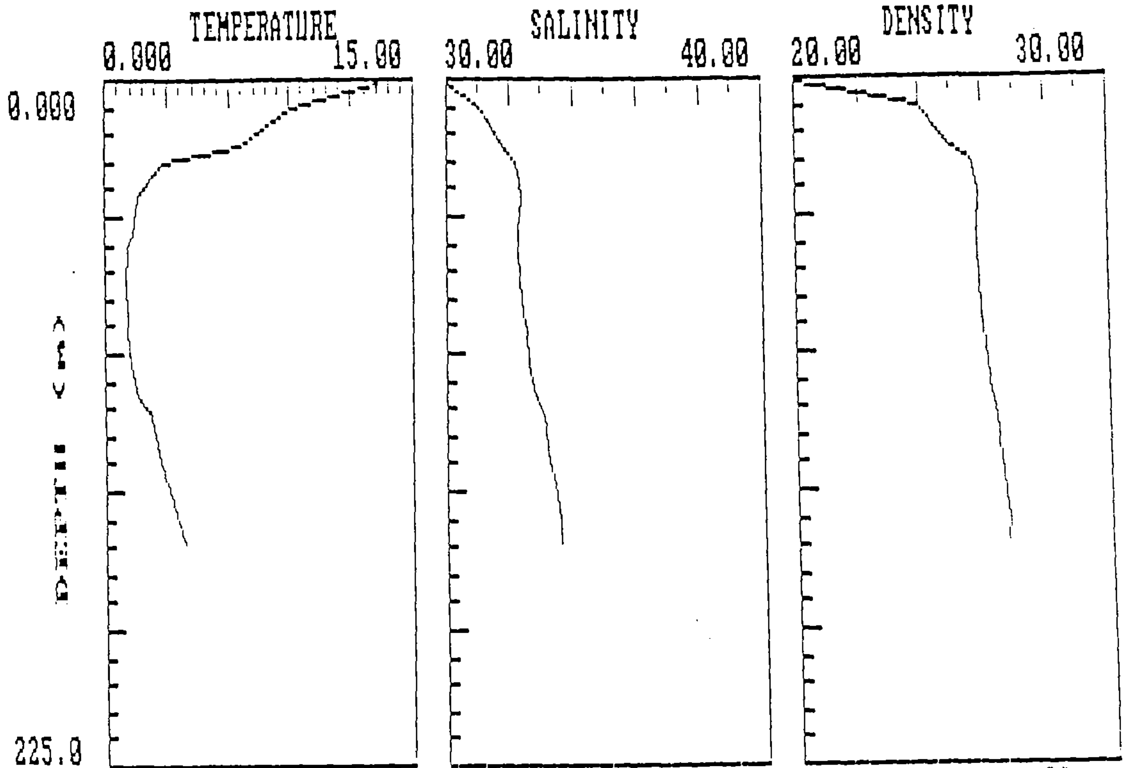
p = 252.39 t = 5.7677 s = 34.6657 d = 27.3207 scnt = 2652
C101-36-CTD



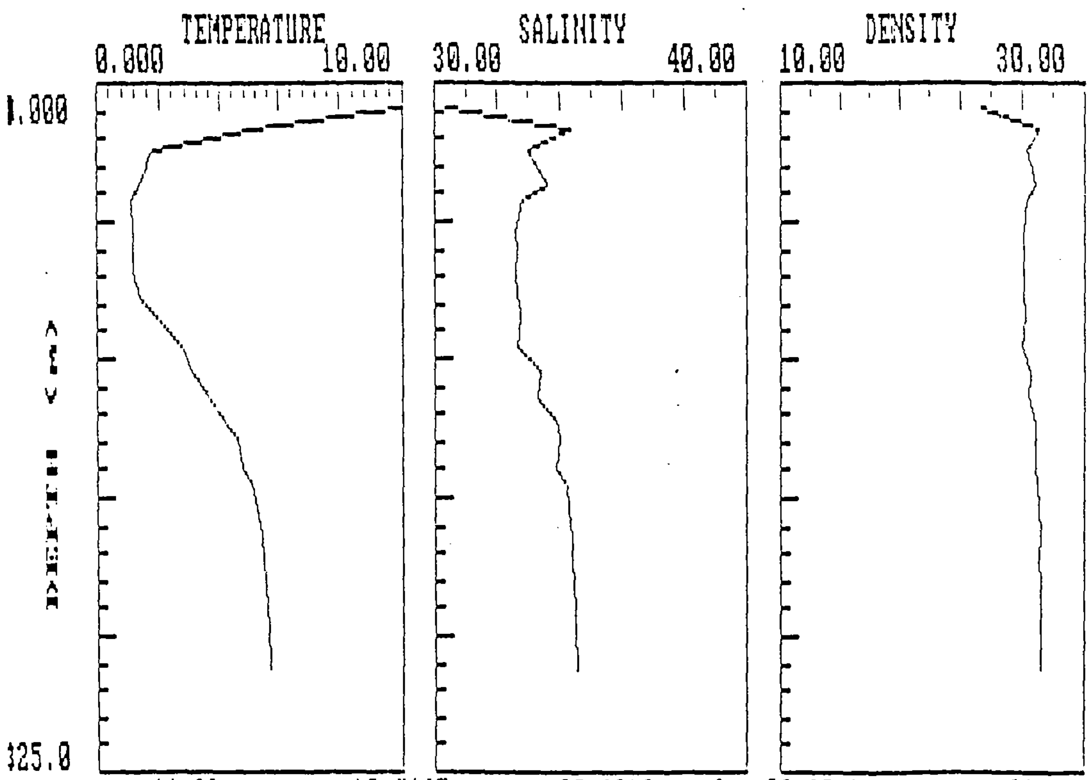
p = -0.37 t = 13.9381 s = 0.0133 d = -0.7346 scnt = 26
C101-37-CTD



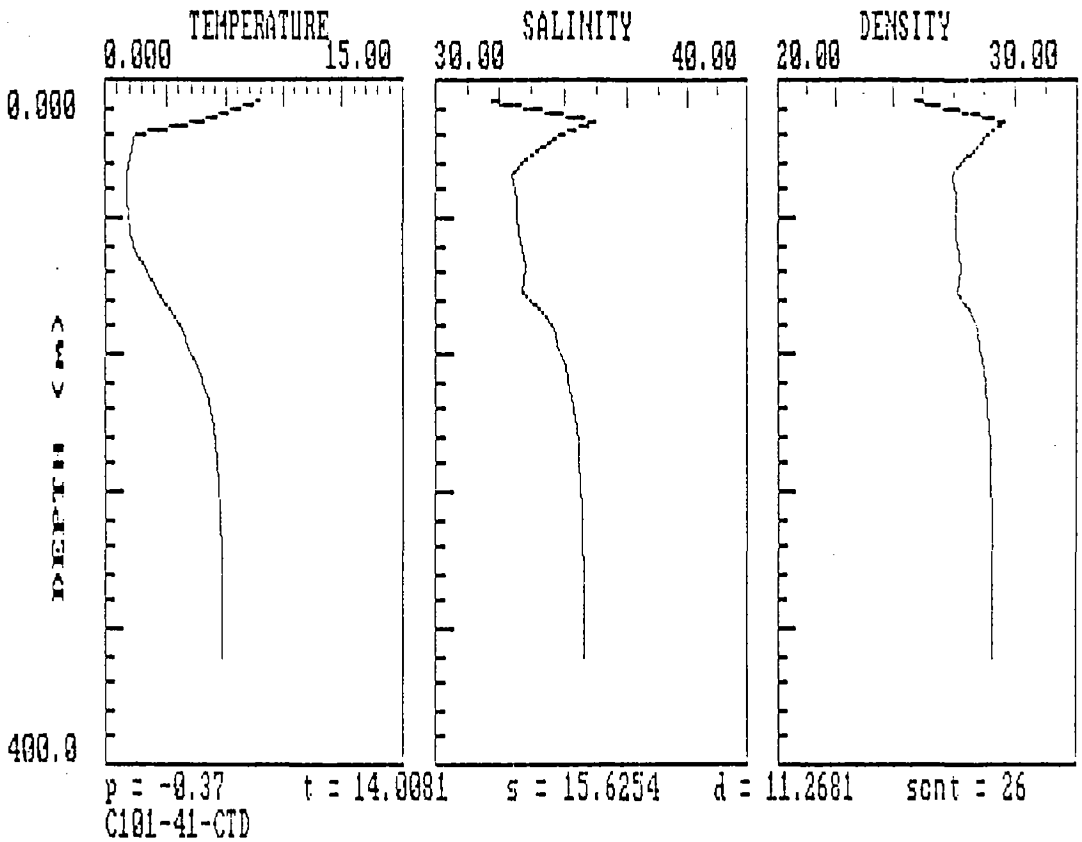
p = -0.37 t = 13.6891 s = 0.0111 d = -0.7023 scnt = 26
C101-38-CTD



p = -0.37 t = 13.2707 s = 0.0115 d = -0.6466 scnt = 26
C101-39-CTD



p = 11.83 t = 10.0167 s = 30.3283 d = 23.3046 scnt = 26
C101-40-CTD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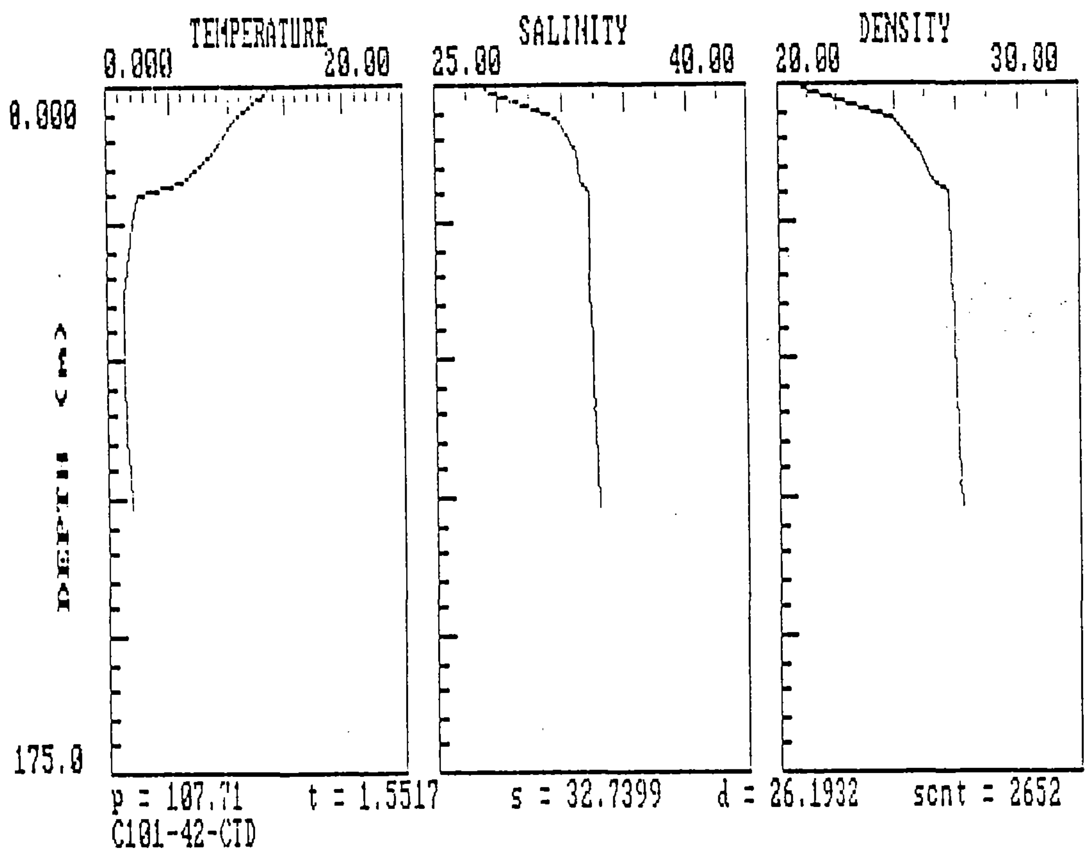
p = -0.37 t = 14.0081 s = 15.6254 d = 11.2681 scnt = 26
C101-41-CTD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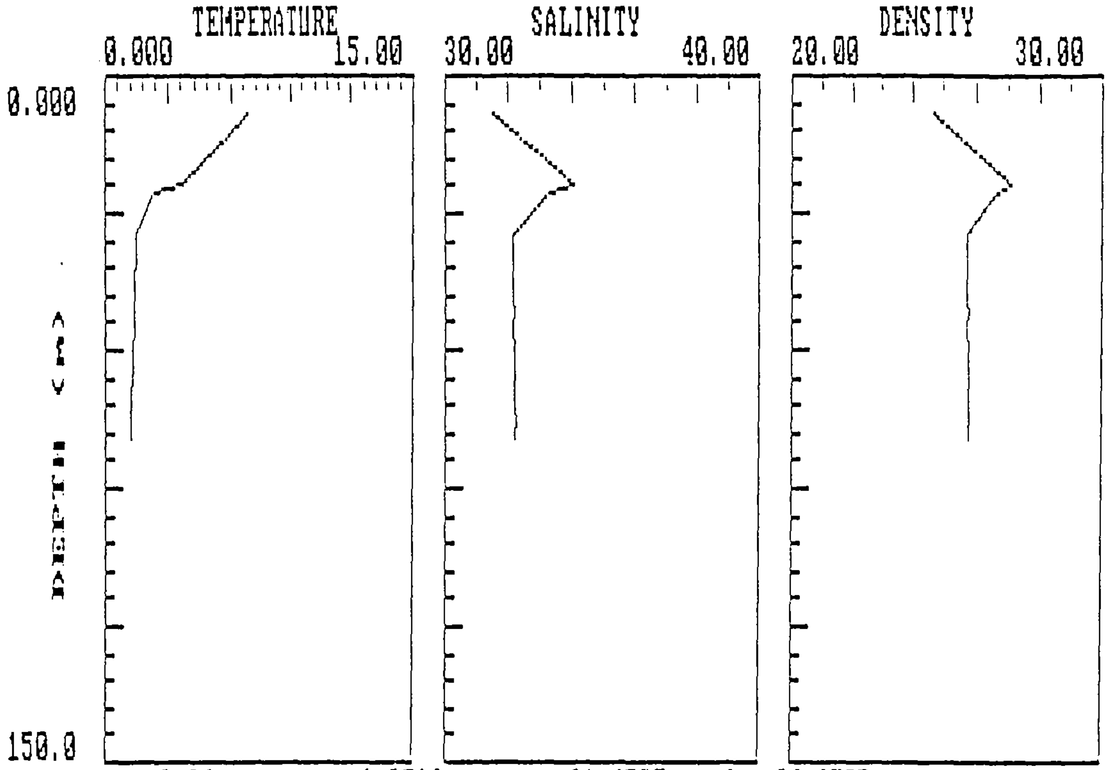
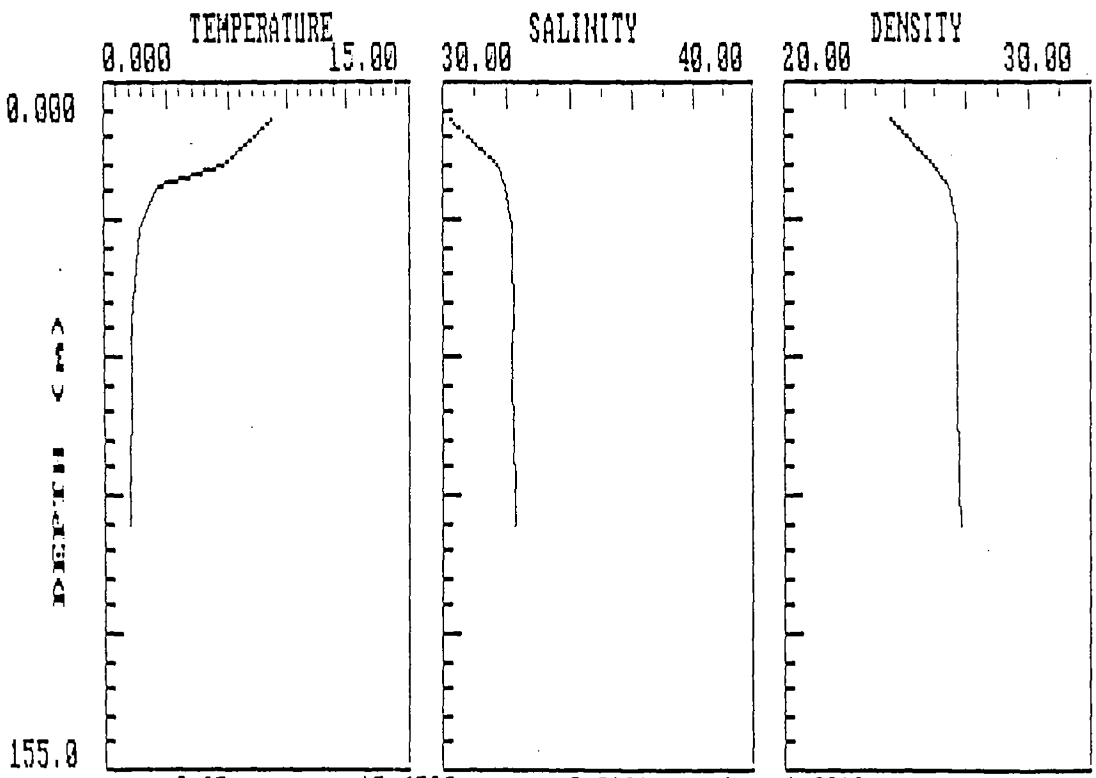
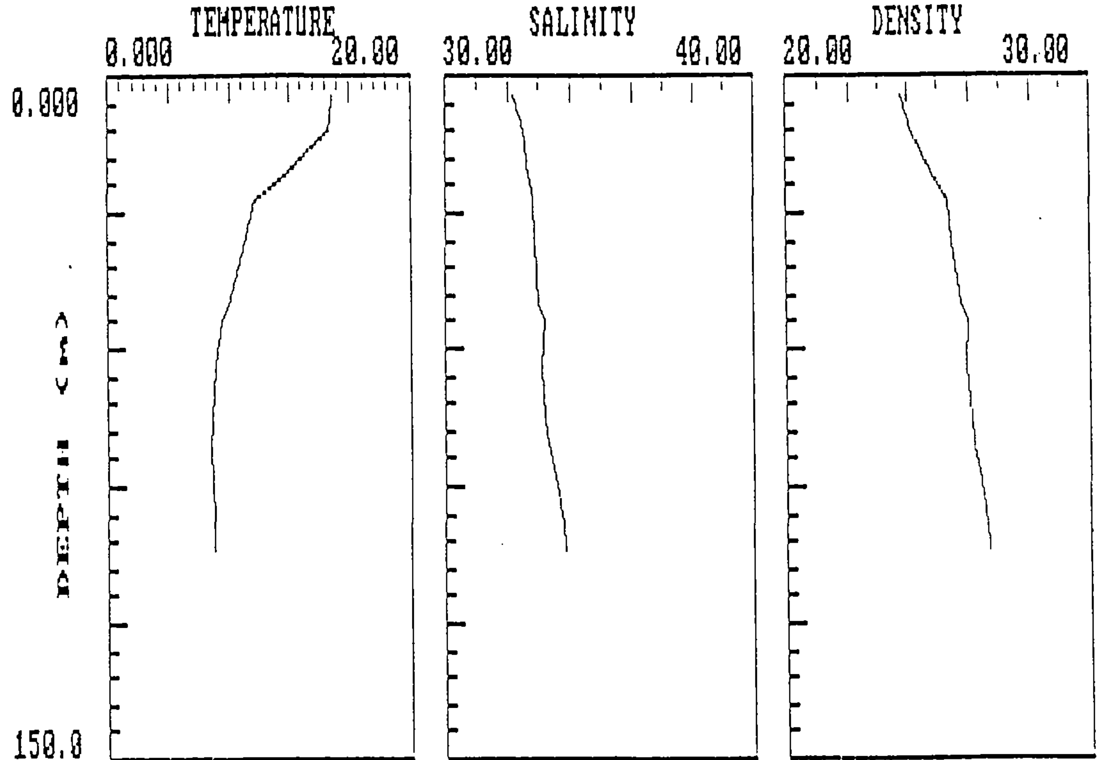
p = 107.71 t = 1.5517 s = 32.7399 d = 26.1932 scnt = 2652
C101-42-CTD



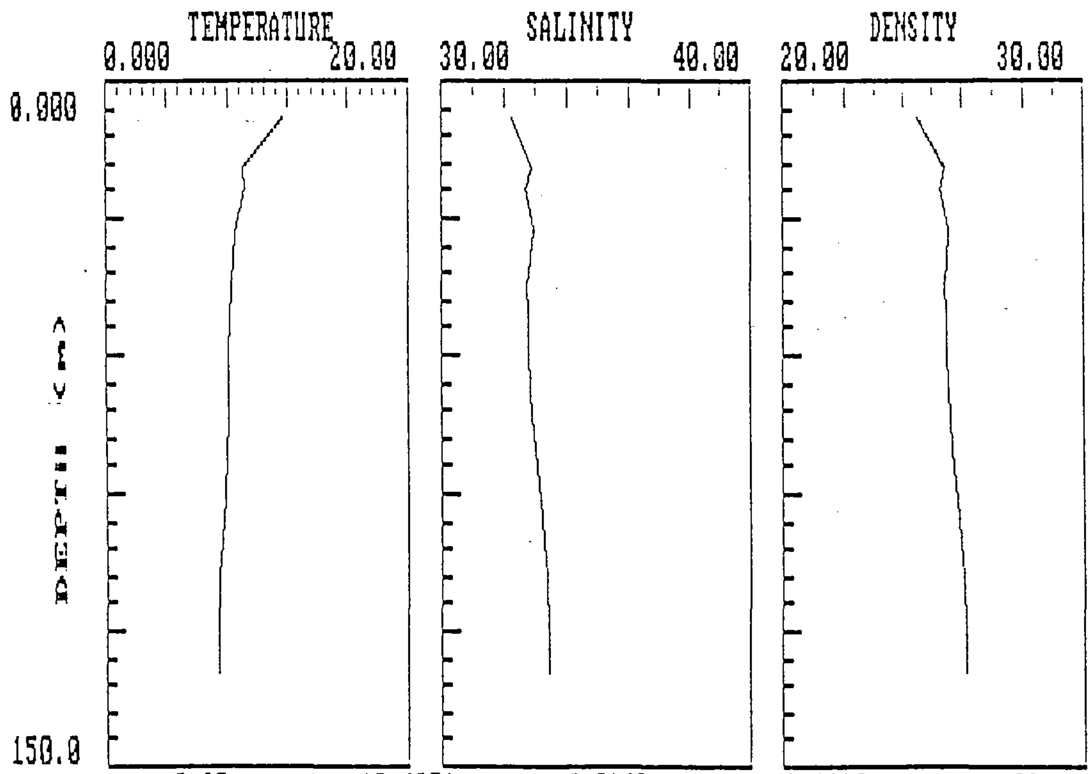
p = 8.34 t = 6.8516 s = 31.4595 d = 24.6505 scnt = 26
C101-43-CTD



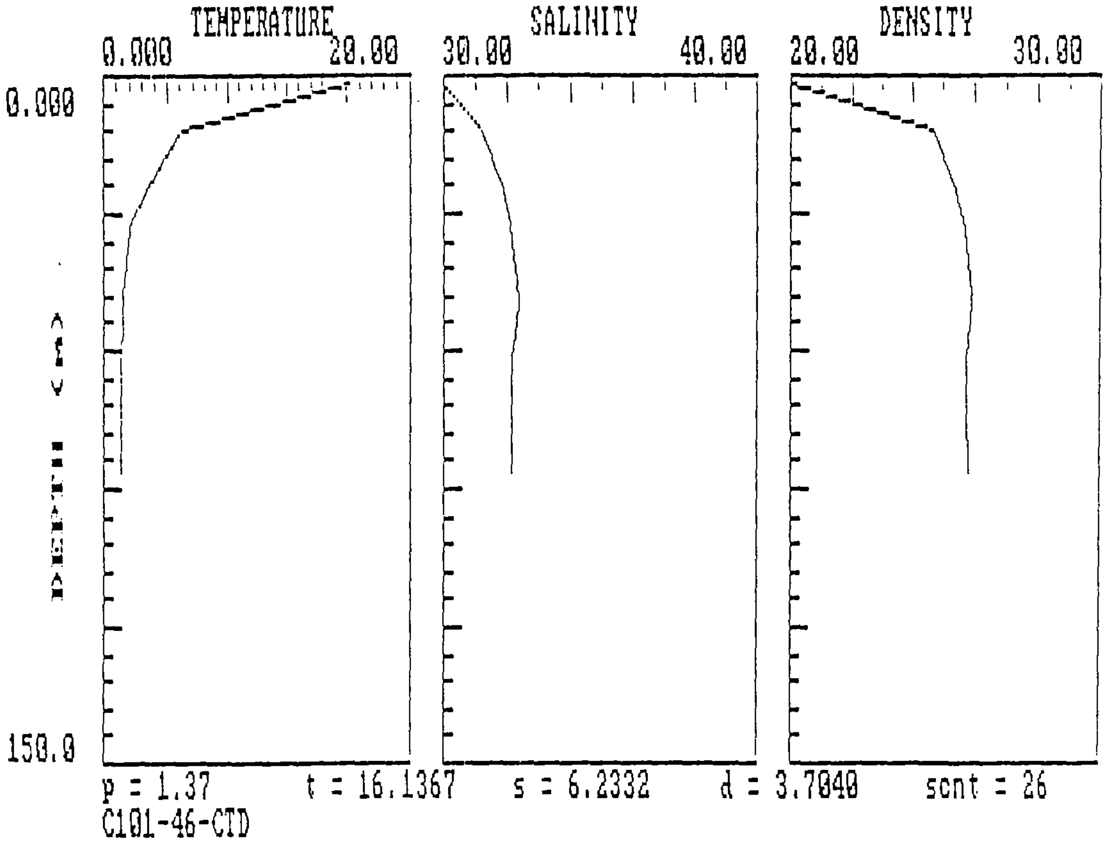
p = -0.37 t = 17.4730 s = 0.0191 d = -1.2918 scnt = 26
C101-44-CTD



p = -0.37 t = 16.1750 s = 0.0147 d = -1.0722 scnt = 26
C101-76-CTD



p = -0.37 t = 17.4871 s = 0.0143 d = -1.2980 scnt = 26
C101-78-CTD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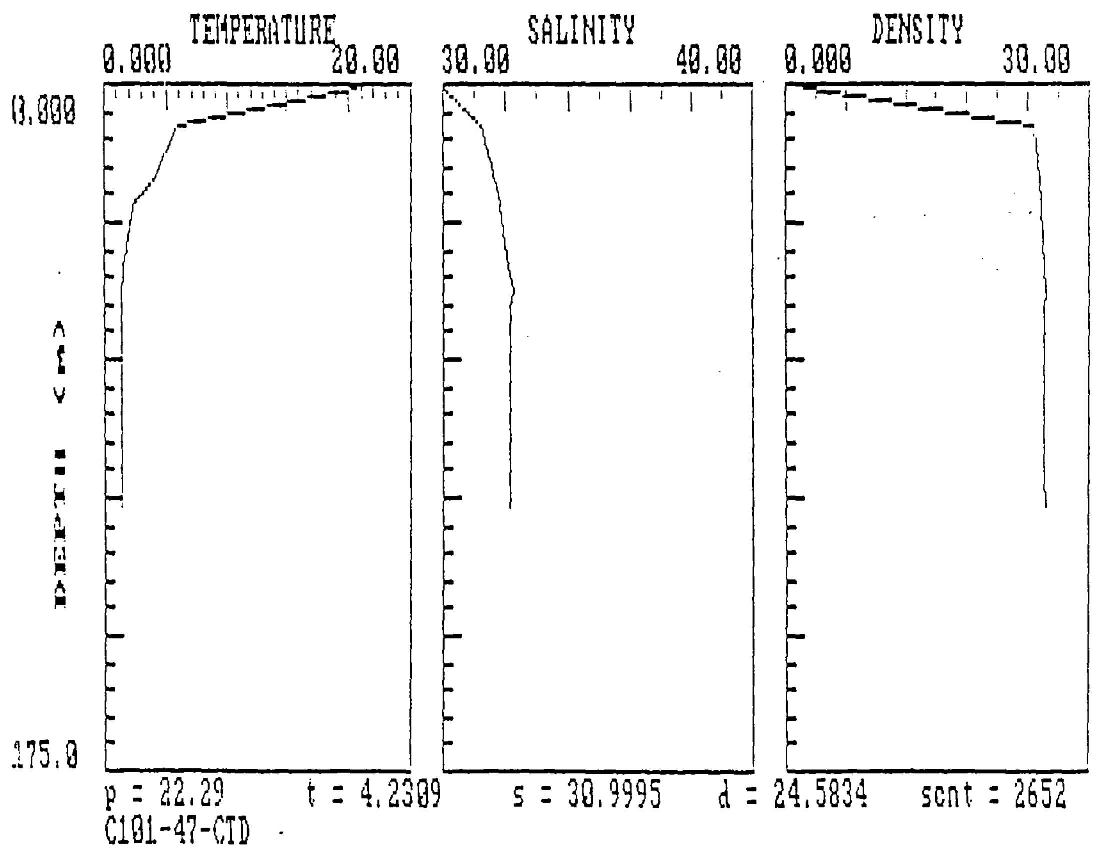
p = 1.37
t = 16.1367
s = 6.2332
d = 3.7040
scnt = 26
C101-46-CTD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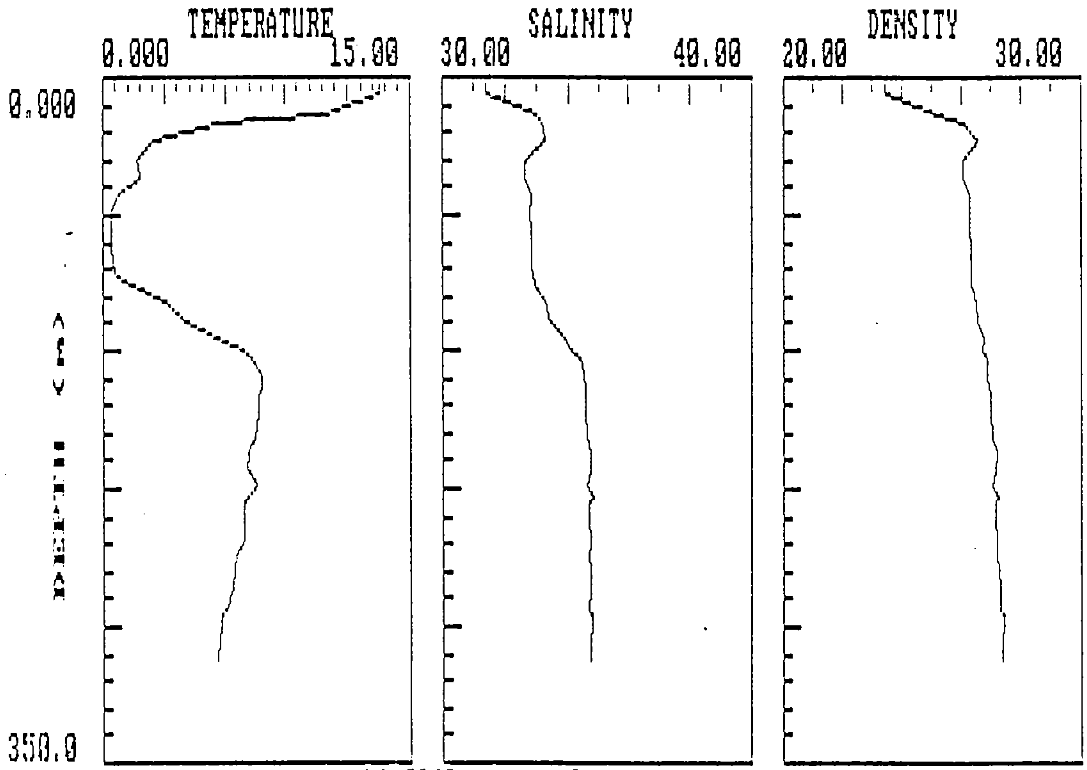
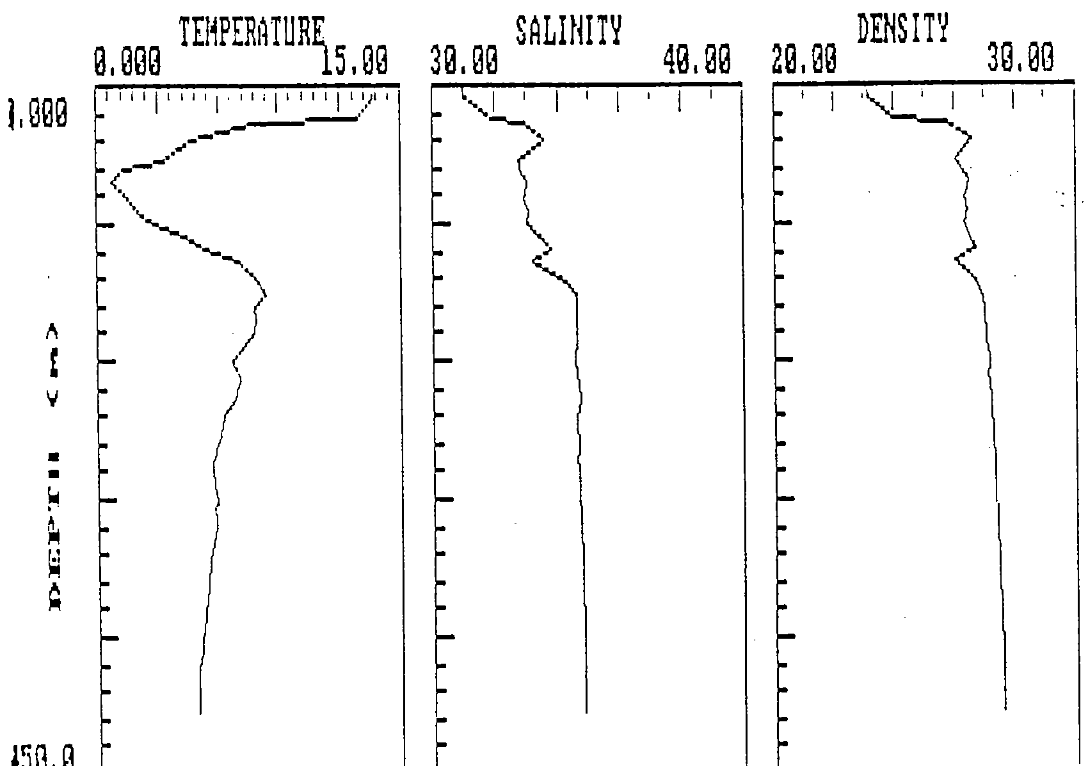
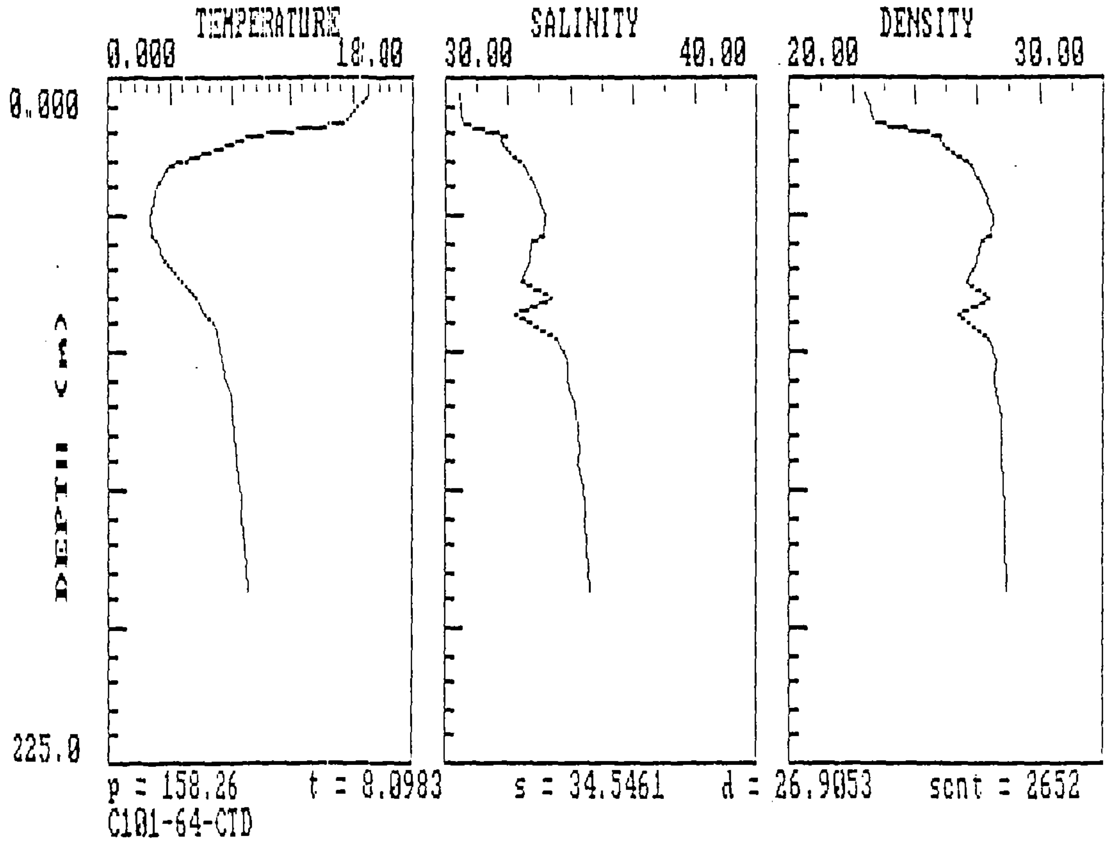
p = 22.29
t = 4.2309
s = 30.9995
d = 24.5834
scnt = 2652
C101-47-CTD



p = -0.37 t = 14.0348 s = 0.0108 d = -0.7500 scnt = 26
C101-53-CTD



p = -0.37 t = 14.4244 s = 0.0110 d = -0.8050 scnt = 26
C101-54-CTD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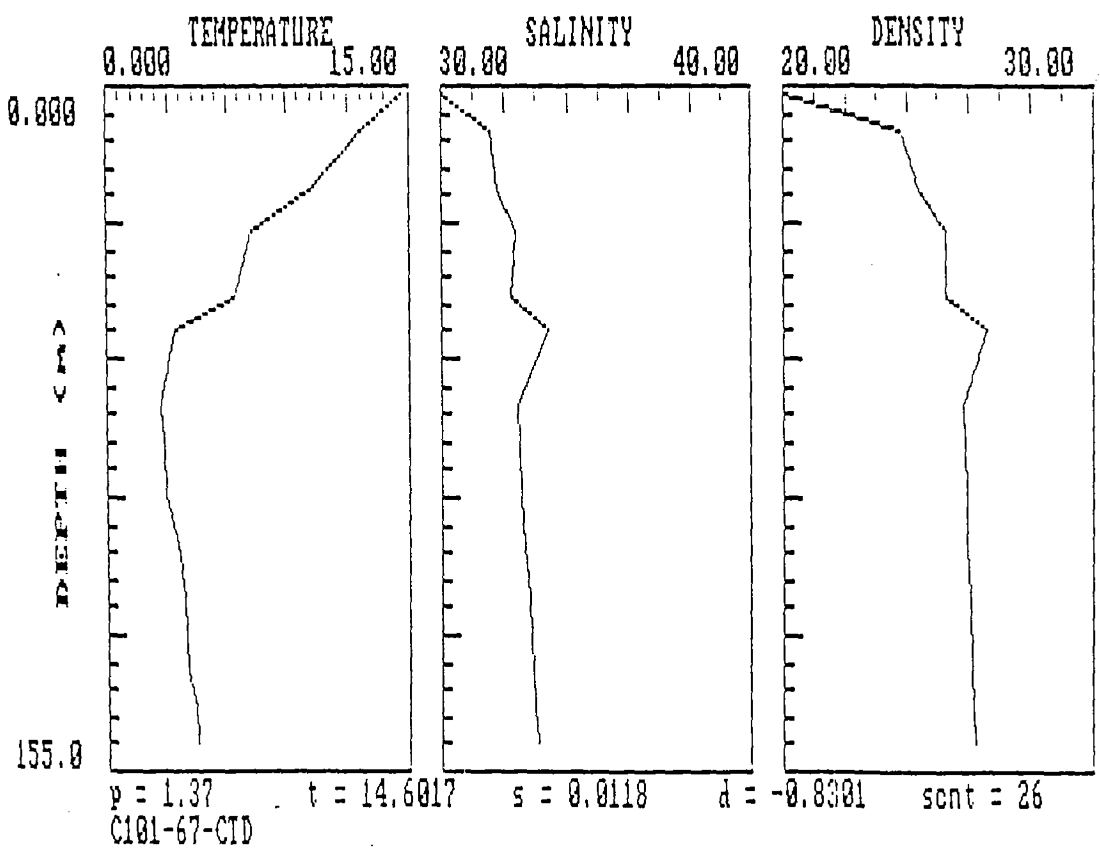
p = 158.26 t = 8.0983 s = 34.5461 d = 26.9053 scnt = 2652
C101-64-CTD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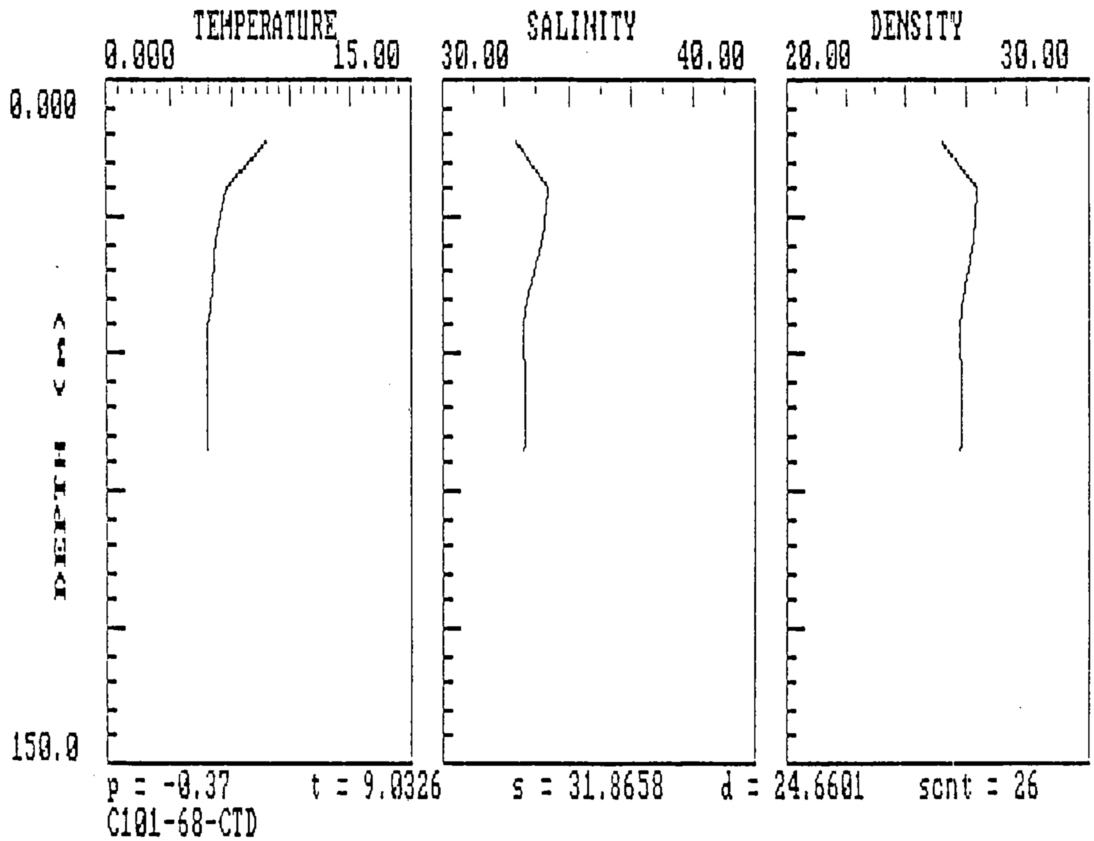
C101-67-CTD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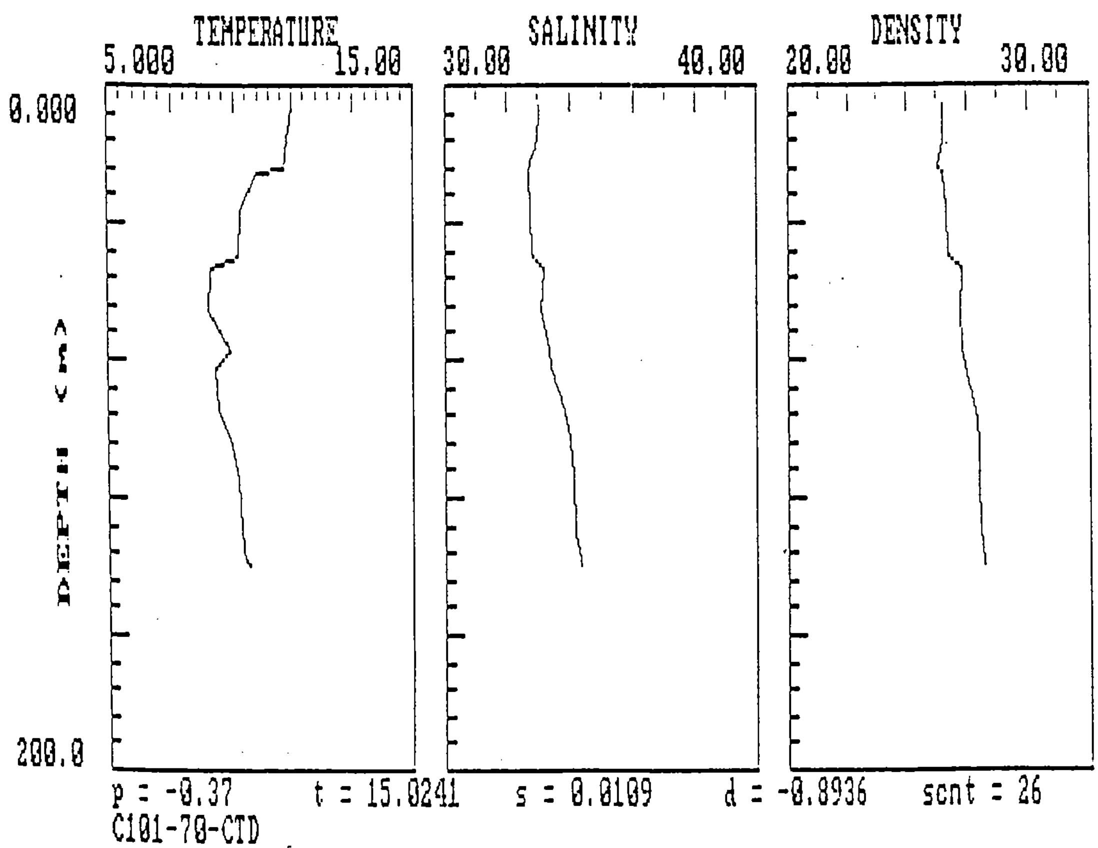
p = -0.37
t = 9.0326
s = 31.8658
d = 24.6601
scnt = 26
C101-68-CTD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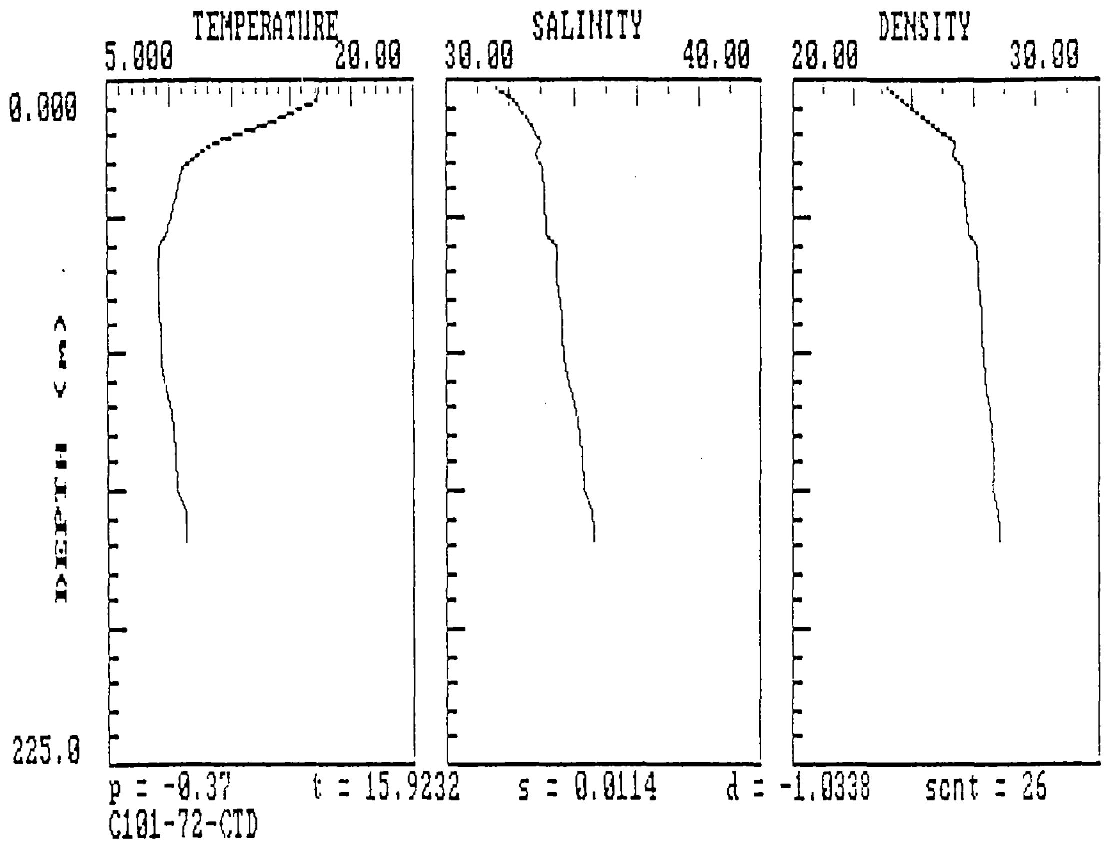
p = -0.37
t = 15.0241
s = 0.0109
d = -0.8936
scnt = 26
C101-70-CTD



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DENSITY
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0.000
DEPTH (m)
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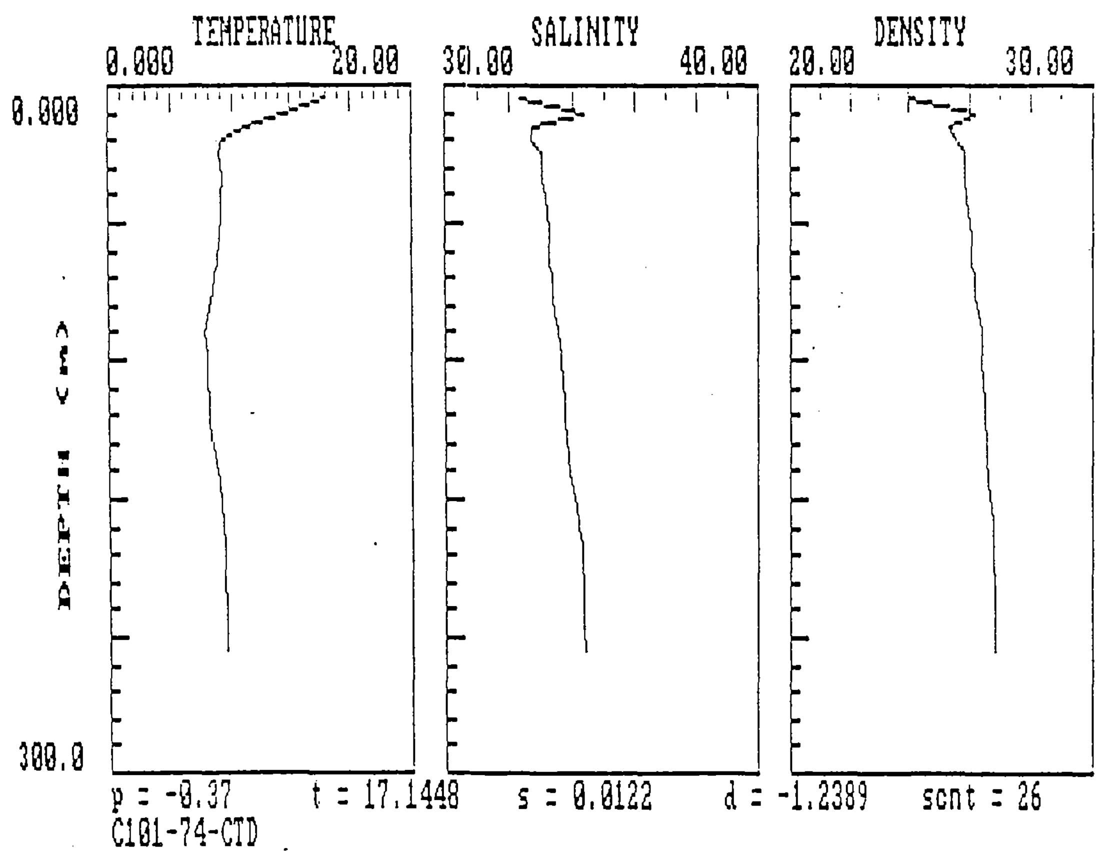
p = -0.37
t = 15.9232
s = 0.0114
d = -1.0338
scnt = 26
C101-72-CTD



TEMPERATURE
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DENSITY
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0.000
DEPTH (m)
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p = -0.37
t = 17.1448
s = 0.0122
d = -1.2389
scnt = 26
C101-74-CTD

APPENDIX 4

The Class of C-101
by Susan Palmer

Although I am no bard,
I've had a lot of fun
writing of the characters and spirit
of our awesome class 101!

Eric cooking in the galley,
he made a fabulous steward;
the sea was cooking too, though,
and he was oft on deck bent leeward!

Sarah is big on swimming,
Sarah from Wisconsin-
she's gone from never seeing the ocean before
to becoming a veritable dolphin!

Matt plays the guitar well,
and wherever he goes exclaims
"sew-eet", "this lags", or
"why am I so lame?"

Jen is having a blast aboard
though her hoops court she misses;
basketball will have to wait while she
investigates sick fishes!

Hank on field day in the engine room
bent over when he coughed-
his ass hit the general power switch
and he turned the whole ship off!

Zimm is always in her bunk
unless her watch a-keeping-
you know if you don't see her
she's down below a-sleeping!

When Forsythe's gear was auctioned off
she immediately bought 'em;
two days of quiet for the girl whose
project is grabbing bottom!

Nikki is her partner, who
keeps them going intactly;
about Forsythe grabbing bottom she says
"my sediments exactly!"

Sarah Parkin was my roomate,
and I'll warn you it gets scary
when its been a bit too long since

she's seen her boyfriend Larry!

Gumby thinks internal waves rule Bay D'Espoir
and just that it well may be-
if he's right throughout the ship you'll
hear "oh baby, oh baby, oh baby!"

Andy Harvard there's a place for you
behind the engine room doors-
let's hope the CRAMER'S pistons do
a helluva lot better than yours!

Sarah Mixter's great on watch,
she gets silly when she's soggy,
and is fast untying gaskets
on the bowsprit when its foggy!

Bob he sleeps above me,
is quiet, doesn't bump or flop,
he's an excellent bunk mate except
he always gets to be on top!

At sea Chris rides the waves,
ashore she rides a motorcy-
cle. In her car tape deck she plays
Creedence Clearwater Revi-
val.

Nicole is a lively spirit
and is our dry wit source residual-
a dead head and granola, she's
a truly natural individual!

Zev tells stories and sings songs
of lovesick hippopotomi-
perhaps he should consider
in port a quick lobotomi!

Poor Ed's verse is difficult
and has made this poet cautious-
I never thought I'd find a good
word that rhymes with nauseous!

To Molly the Harvardian poetry major,
I feel a kinship with you,
as well as on deck with rigging where
neither of us has a clew!

Greg told a boring story to
his undergarment retrieve;
the judges should have told him
to instead of shorts be brief!

Andy is an excellent fellow
even though he is from Bowdoin-

for him I wish the best of tar
ever the neuston towed in!

Mel, she has a bright outlook
even among the yakkers-
we can certainly forgive her
for eating all the crackers!

Cam, BIG GUY, we think
that there is a correlate
between post-meal rocking of the boat
and how much you ate!

Karen has a fiance' ashore
who brings her joy and mirth,
we hope he understands back home when
she explains she's had a berth!

When I completed the verses above,
I counted only twenty-three;
I confess it took me half an hour to figure
the missing one was me!

So I am now finished,
in my duty was not slack-
I hope that you all liked it so
I can have my sweatshirt back!

MEMORABLE QUOTES

Bill: "You are now in the zone of death."

Terry: "So Bill, what are you going to do with all that Nobel Prize money?"

Eric: "Clean for two hours, puke for an hour, that gives you a net total of one hour cleaning."

Cam: "Hey big guy!"
Sue: "I'm not a big guy, I'm a little woman!"

Sarah H.: "Whenever I wake up, I always feel so confused."

Molly on compasses: "You can only end with one of the four big ones."

Mel: "Can you watch the bow while I go and put my pants on?"

Greg: "Just say no to formalin."

Hank: "Did you make any peanut butter cookies without peanut butter?"

Matt: "Isn't it the best when you make someone laugh so hard that they throw-up."

Nasty Nicky: "I know my boobs are really small, but you guys are gonna smush-em into one!"

John: "Man, it would be a bummer if you were a sea cucumber."

Beth: "Hold the neuston net while I clean all the goobies off."

And finally,

Zev: "Why is there fog out there?"

To everyone of C-101, thank you for making my first cruise so much fun, Mr. Winch excluded - of course: Bill.